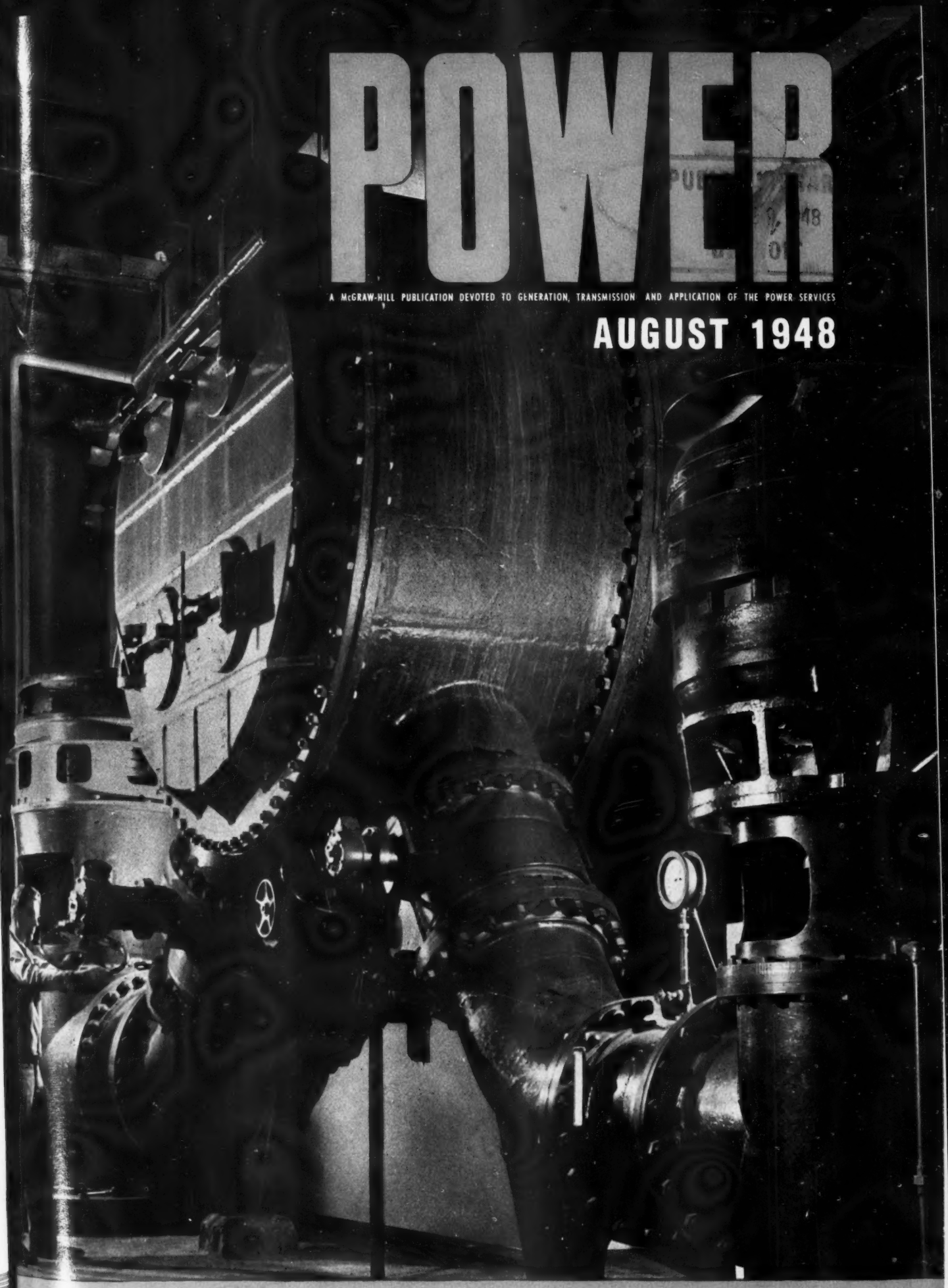
POWER

A McGRAW-HILL PUBLICATION DEVOTED TO GENERATION, TRANSMISSION AND APPLICATION OF THE POWER SERVICES

AUGUST 1948



IN THIS ISSUE: Putting "big-plant thinking" into the small plant produces low-cost efficient layout for Seattle laundry, p 64; extension ups Grand Haven municipal diesel capacity to 13,370 hp, believed to be largest in U. S., p 74; engineering analysis of new rotary vacuum pumps for condenser air-removal service, p 82. **TABLE OF CONTENTS, p 59**

Lettin' the Cat outta the Bag!

Left— A-S-H Automatic Sequence Head of the Automatic Sequence Hydrovac. Note that the initials of both are the initials of our company's name, A-S-H, Allen-Sherman-Hoff. This equipment "practically thinks for itself," and while its initial cost is higher than manually operated systems, it is actually more economical in the long run, because of what it saves in time and maintenance. Often it pays for itself in about a year.

It took five long years of designing, experimenting and building to perfect the new Automatic Sequence Remote Control Hydrovac System for handling anything from the finest dust up to loose, bulk granular materials of various sizes. To the men and companies contributing to this development, quite aptly referred to as the "Pneumatic Materials Handling System of Tomorrow," we express our heartfelt thanks. . . . We are "Lettin' the Cat Outta the Bag" with the publishing of a new catalog, covering manual and automatic systems for handling material in metal and non-metallic mines, coal burning generating and heating plants, process industries, etc. . . . A letter from you will bring one of the catalogs very promptly. If your problem is urgent, tell us in the letter that you want an engineer to bring the catalog and discuss your particular job with you.

ALLEN-SHERMAN-HOFF CO., 227 S. 15th ST., PHILADELPHIA 2, PA. ***Offices & Representatives in Principal Cities***

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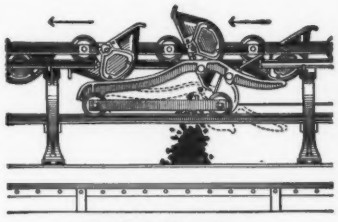
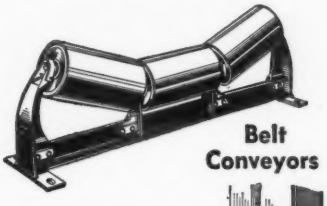
LINK-BELT EQUIPMENT

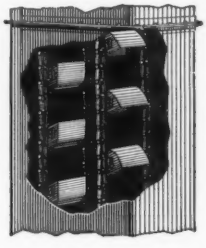
Meets Every Need of Industry in Handling Coal and Ashes



Bucket Carriers



Belt Conveyors



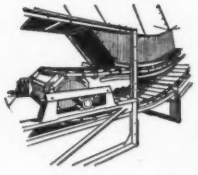
Bucket Elevators

Bulk-Flo

Screw Conveyor

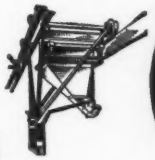
Skip Hoist

Coal Crusher



Feeders

Car Dumper



Weigh Larry

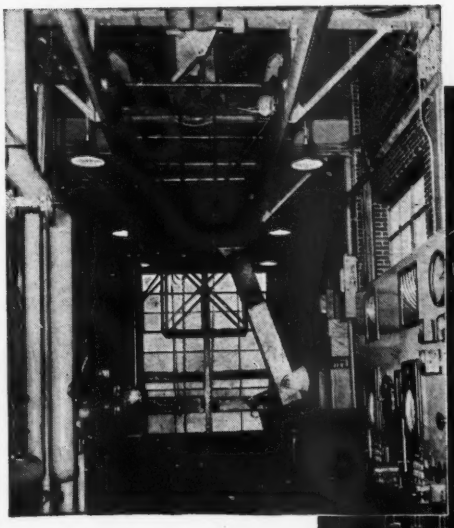


Photo at left shows interior of boiler room with weigh larry in foreground, at Riegel Textile Company.

LINK-BELT Coal Handling System *provides flexibility at Riegel*

In the boiler plant phase of the continuous modernization of Riegel Textile Company, Trion, Ga., flexibility was a major consideration. To circumvent fuel emergencies, the two steam generators were planned to switchover from one fuel to another.

Flexibility and efficiency in coal handling are provided by an integrated system of Link-Belt standardized units. The sketch above shows the components. Coal is received through grating to track hopper. An apron feeder serves the pulverizer. Crushed coal is taken by bucket elevator to top of bunkers where it is distributed by screw conveyor. Duplex discharge gates permit self-propelled weigh larry to distribute to coal receiving chutes.

We will be glad to give you further details of this and other cost cutting installations. Get in touch with our nearest office.

LINK-BELT COMPANY

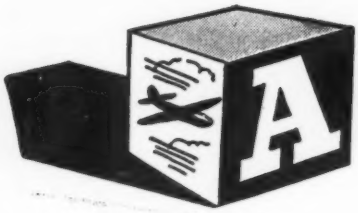
Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices in Principal Cities.

11,191

LINK-BELT

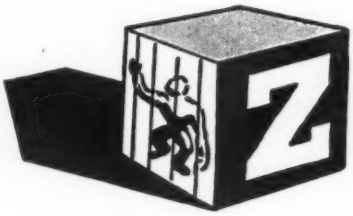
THE SYMBOL OF QUALITY — LB — LINK-BELT

COAL AND ASHES HANDLING EQUIPMENT



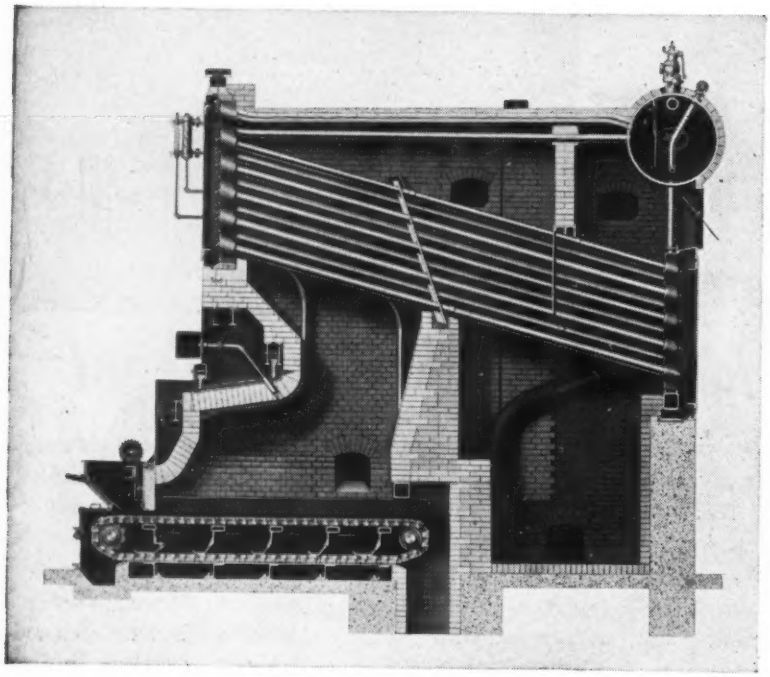
AIRPORTS

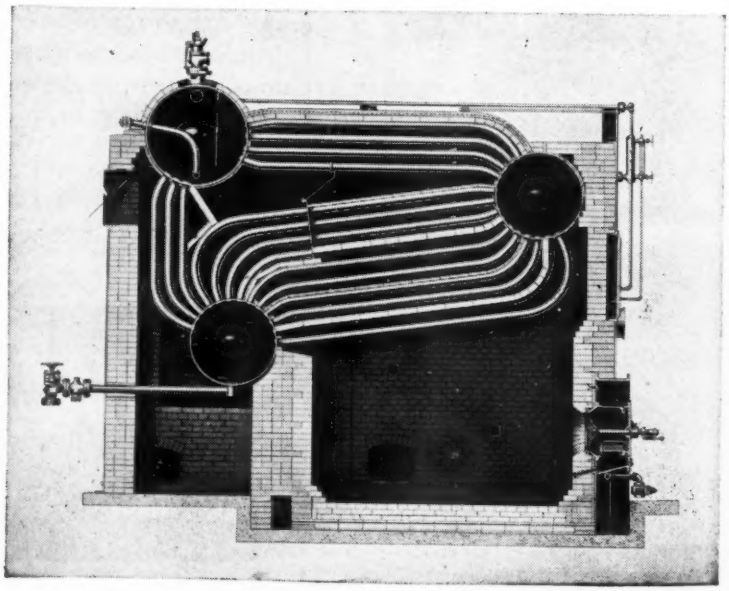
to



choose...

...B&W





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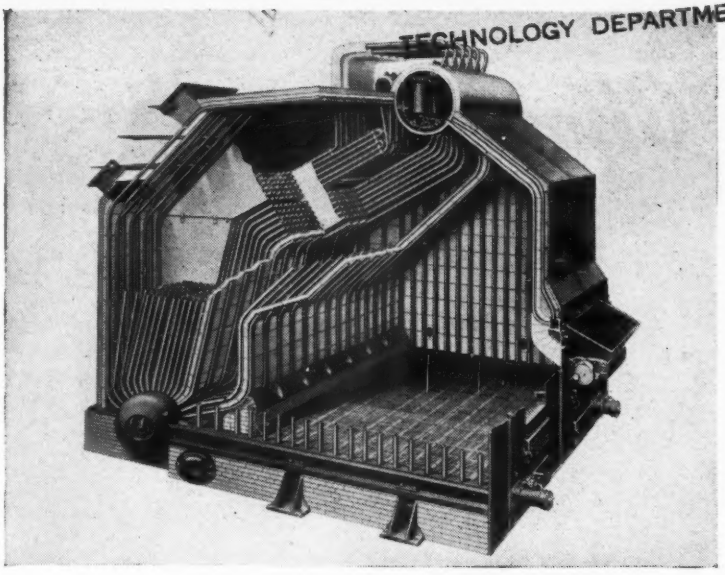

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"CUBS"*

How well the three B&W CUBS* fit into present-day power plans calling for boiler capacities up to 60,000 lb. per hr. at pressures above 160 psi. is clearly reflected in the heavy, industry-wide demand for these complete, compact units. Steam requirements of over 4,500,000 lb. per hr. will be supplied by CUBS* ordered since the first of this year for commercial and industrial installations ranging from airports to zoos. Each of these units has distinctive features that make it the best buy in boilers for specific service conditions, yet ALL three CUBS* offer the cost-saving benefits listed at the right.

***Complete Unit BoilerS**

Each as much a package boiler as any unit of its capacity can be.

ALL are fully coordinated, flexible units—from fuel burning equipment to breachings and stacks—built and installed under undivided responsibility.

ALL are time-tested, performance-proved units of simplified design and standardized manufacture.

ALL fully meet modern requirements as to fuel flexibility, compactness, ease of operation, fast-steaming and ability to take sudden load swings.

ALL sustain high operating efficiency over their wide range of output, and generate steam of satisfactory quality at all ratings.

ALL have provision for superheated steam.

ALL embody design, construction and operating features that account for the heavy preference for larger B&W boilers for central stations and large industrial applications.

ALL are matched to their jobs for highest standards of performance, continuity of service and long-term economy.

G-382T

B&W

FOR POWER PLANTS — B&W, Open-Pass, Radiant, Integral-Furnace, Cross-Drum, Stirling and Waste-Heat Stationary Boilers . . . Air Heaters . . . Economizers . . . Superheaters . . . Water-Cooled Furnaces . . . Oil, Gas & Multi-fuel Burners . . . Chain-Grate Stokers . . . Stacks and Breechings . . . Seamless & Welded Tubes . . . Refractories . . . Chemical Recovery Units . . . Alloy Castings.

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OTHER B&W PRODUCTS — Marine Boilers . . . Pressure Vessels . . . Process Equipment.

BABCOCK & WILCOX

THE BABCOCK & WILCOX CO.
GENERAL OFFICES: 85 LIBERTY ST., NEW YORK 6, N.Y.
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Take your Choice of . . .

6 governors

1. Constant-speed mechanical shaft governor—
   Speed range—1000-4500 rpm.
   Speed adjustment—none (Hand-operated speed changer can be supplied).
   Steady-state speed regulation—8%.

2. Variable-speed orifice type—
   Speed range—800-6000 rpm.
   Speed adjustment—From 1.3:1 to 5:1, while running.
   Steady-state speed regulation—8% maximum speed—20% minimum speed.

3. Same as No. 2, with air-operated remote control.

4. Constant-speed oil relay type—
   Speed range—1000-4500 rpm.
   Speed adjustment—none (Hand-operated speed changer can be supplied).
   Steady-state speed regulation—4%.

5. Variable-speed oil relay type—
   Speed range—800-6000 rpm.
   Speed adjustment—3:1, while running.
   Steady-state speed regulation — 4% at maximum speed, 10% at minimum speed.

6. Built-in constant or differential pressure pump type—
   Speed range—0-4500 rpm.
   Pressure adjustment dependent on governor design.
   Constant-speed mechanical shaft governor acts as pre-emergency governor only.

With all of these governors, the standard independent overspeed governor is furnished.

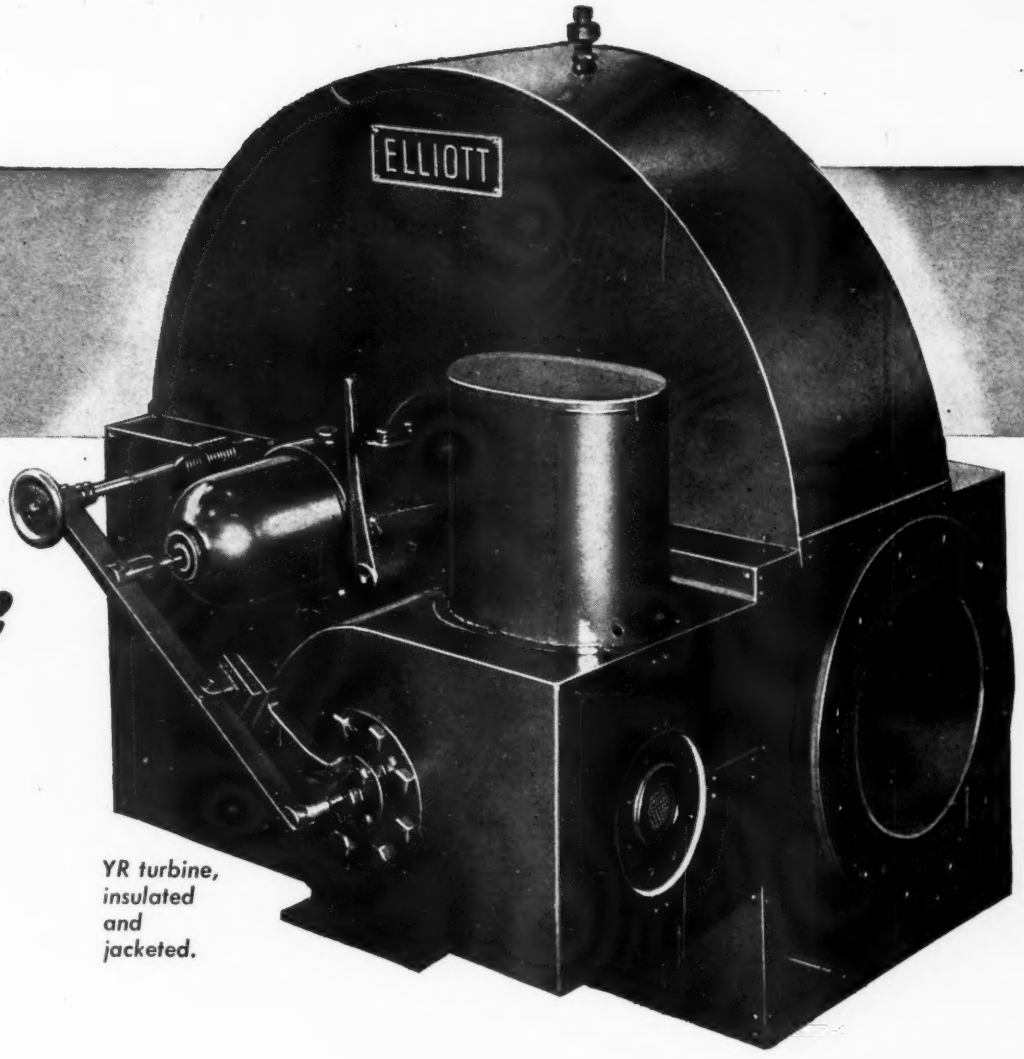
in this versatile Tu

Whatever your steam turbine governing requirements, they can be met by one of the six governors listed at the left. Constant speed, normal regulation, close regulation, or any combination of these, may be obtained as required.

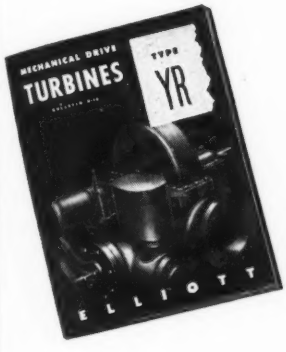
These governors can be put on all FIVE frame sizes, for ratings of 1 to 2000 hp, speeds of 800 to 6000 rpm, for back pressures through 250 psig.

The many improved design features of Elliott YR turbines all add up to better operation and minimum maintenance.

Elliott



YR turbine, insulated and jacketed.



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H-718

"YR" the turbine for any application

Diamond Soot Blowers

TO SUIT YOUR INDIVIDUAL NEEDS

AIR CLEANING

TYPE OF OPERATION	TYPE OF CONTROL
AIR ELECTRIC MANUAL	AIR ELECTRIC AIR-ELECTRIC MANUAL

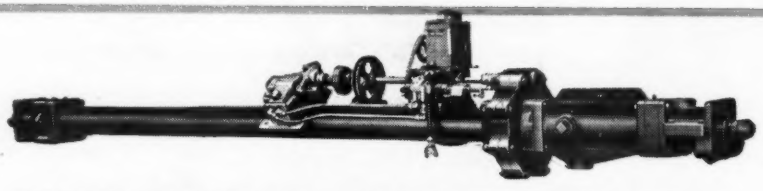
STEAM CLEANING

TYPE OF OPERATION	TYPE OF CONTROL
AIR ELECTRIC MANUAL	AIR ELECTRIC AIR-ELECTRIC MANUAL

DIAMOND MODEL IR Short Retracting Soot Blower

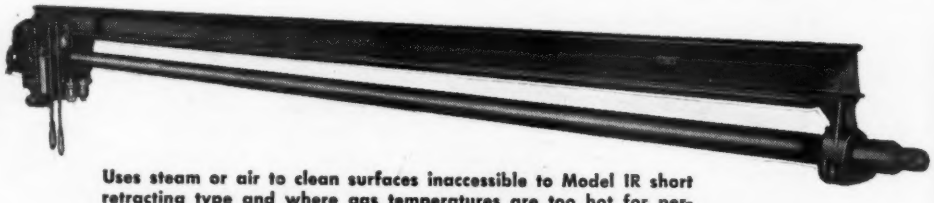
For cleaning furnace walls or boiler heating surfaces where gas temperatures exceed limit for permanently installed units. Equally applicable to compressed air or steam as a cleaning medium. Manual, air, or electric operation. Advantages include: positive poppet type valve, 12" travel, no lubrication, simple construction, exceptional durability, etc.

DIAMOND TELESCOPIC Long Retracting Soot Blower



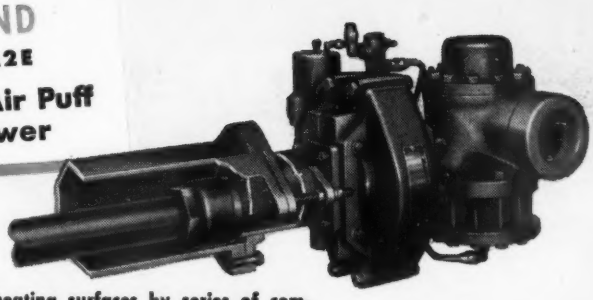
Used where insufficient clear space outside boiler will not permit installation of Model IK retracting blower for cleaning surfaces inaccessible to short retracting blower and where gas temperatures are too hot for permanently installed units. Uses air or steam as cleaning medium. Either electric or air operation.

DIAMOND MODEL IK Long Retracting Soot Blower



Uses steam or air to clean surfaces inaccessible to Model IR short retracting type and where gas temperatures are too hot for permanently installed soot blowers. Three standard sizes have travels of 10', 12' and 16'; also special travels up to 20'. Either air or electric operation.

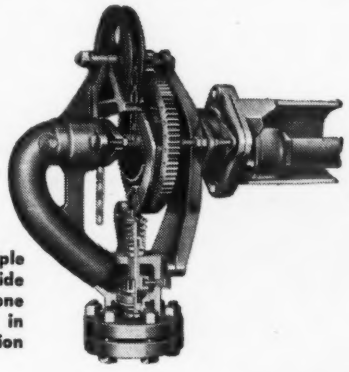
DIAMOND
MODEL A2E
Automatic Air Puff Soot Blower



Automatically cleans heating surfaces by series of compressed air puffs delivered through standard multiple nozzle blowing element. Spreading cleaning cycle over longer time permits smaller compressor and receiver . . . also eliminates stack discharge nuisance.

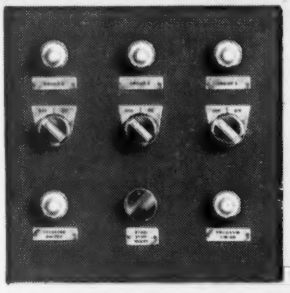
Master Controller automatically controls blowing time and sequence. Just a "twist of the wrist" to open valve . . . controller does rest. Automatic control assures correct boiler cleaning and no labor is needed.

DIAMOND
MODEL G9B
Soot Blower



Uses steam as cleaning medium through multiple nozzle blowing element permanently installed inside setting. "Automatic Valved" requiring only one continuous operation to open and close valve in head and simultaneously rotate element. Operation is manual, air or electric.

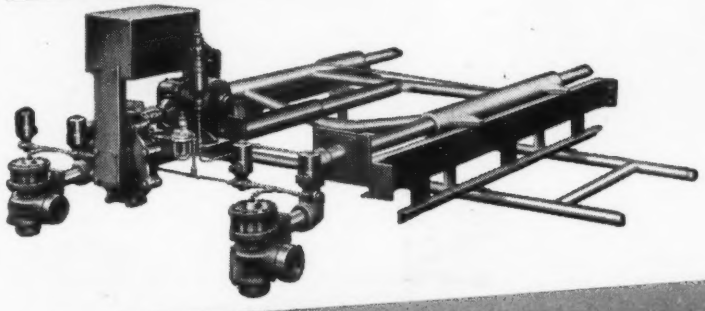
DIAMOND
ELECTRIC
Control Panel



For controlling any combination and number of blowers. All are operated in correct sequence and at right blowing speed by pushing one "start" button.

DIAMOND
AUTOMATIC
Air Heater Blower

One or more multiple nozzle blower elements supported on frame which traverses in straight line across tube sheet. Blowing medium is compressed air discharged intermittently to limit compressor and tank size. Air or electric operation—air or electric control, completely automatic.



DIAMOND
AIR
Control Panel

Can be arranged for controlling any number of blowers or groups of blowers. Correct cleaning is always assured and labor is saved.

Operating conditions and individual preferences vary so greatly that there is need for wide choice in soot blower types and soot blowing methods.

Diamond offers the greatest choice in both methods and blowers—from simple manually operated steam or air cleaning to Diamond Automatic Sequential Blowing which cleans the boiler completely at the turn of a switch. There is a Diamond combination to do a better cleaning job on any type boiler.

DIAMOND POWER SPECIALTY CORP.

DETROIT 31, MICHIGAN

Diamond Specialty Limited • Windsor, Ontario

Life-Line

SMASHING IMPACT caused by dropping this Life-Line motor onto hard concrete pavement failed to do more than mar the finish—a shock test no cast iron can stand.

TERRIFIC PUNISHMENT PROVES STRENGTH OF INDUSTRY'S NEW ALL-STEEL MOTOR!

Over a quarter of a million now in service set best performance record in 58 years of manufacture

Motors seldom have to withstand dropping onto concrete pavement—but they do meet constant stresses and unexpected shocks on almost any job in industry.

The fact that Westinghouse Life-Line motors can withstand such extreme examples of abuse is one of the reasons for the startling records of the more than a quarter million Life-Lines now in service.

The performance record of these units has been six times better than that of any other motor design built by Westinghouse in its 58 years of motor manufacture.

Life-Line's heavy steel construction is one of the benefits that has come to industry out of war experience, when motors built for use on Naval vessels proved the much greater shock resistance of steel over cast iron.

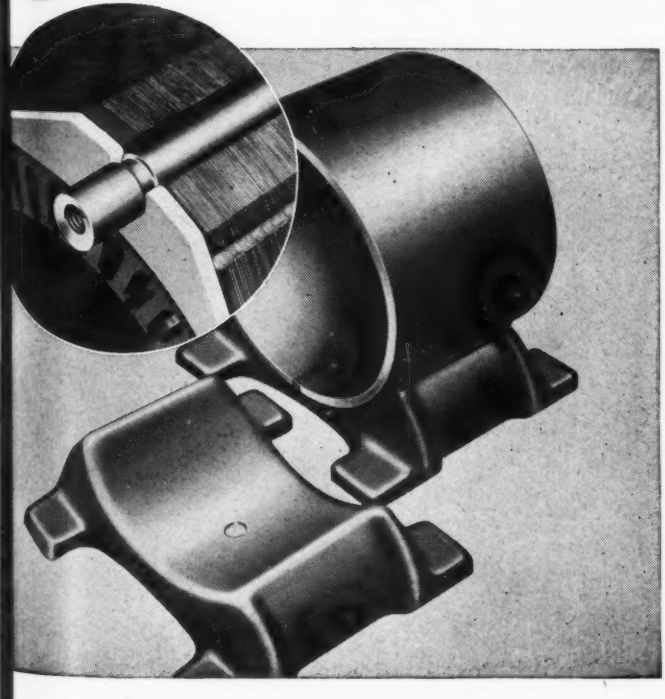
The heavy steel "barrel" frame and "bridge-truss" foot construction has given the motor a rigid, yet resilient structure; at the same time, it has saved as much as 35% in space requirements over other methods of construction. The streamline of the Life-Line blends smoothly with modern machinery.

Get the full facts on Life-Line—its pre-lubricated bearings—its new electrical strength—and the reduced space and weight requirements—they're *all important* gains for your equipment.

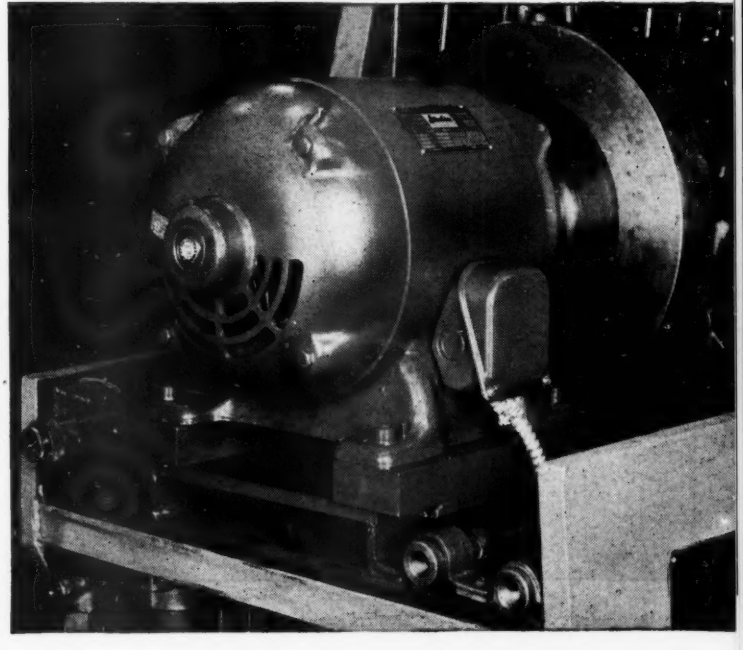
Immediate delivery on standard and near-standard Life-Line motors, from 1 to 15 hp, in dripproof, splashproof and totally-enclosed types; short delivery available on the specials in these frame sizes. The Life-Line design is rapidly being carried through the larger sizes. Check your nearest Westinghouse office, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-21454

Westinghouse
PLANTS IN 25 CITIES ... OFFICES EVERYWHERE

Life-Line motors

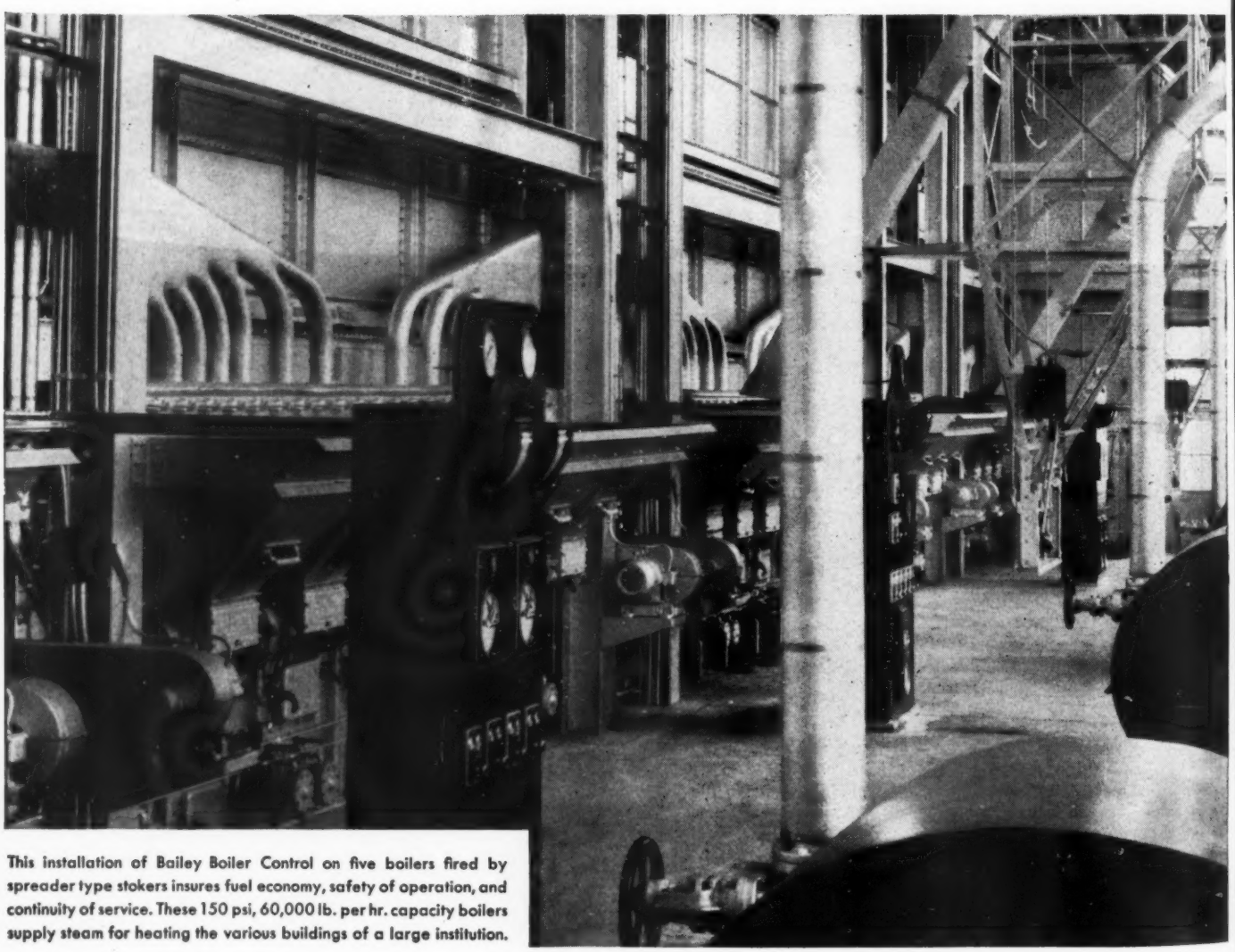


STEEL STRENGTH starts with heavy rolled plate which forms Life-Line motor frame. Brackets and feet are heavy pressed steel. Clamping bars and plates, bearing hubs and even conduit boxes in Life-Line motors, are made of sturdy steel.



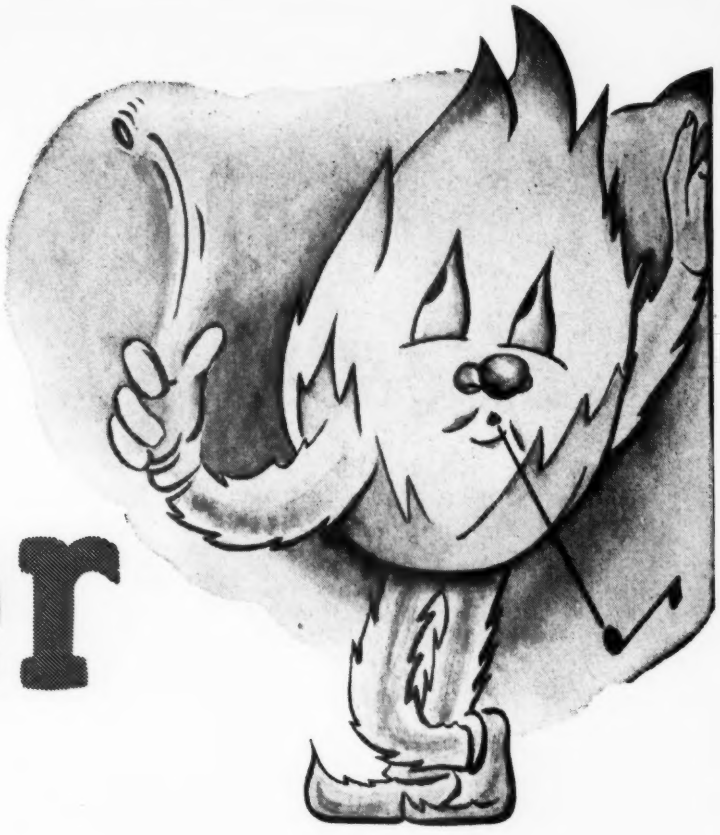
TOUGH JOBS—the shock loads of punch presses, drop hammers and other strenuous machine tool applications; these are places where Life-Line's greater resistance to shock means longer life and more trouble-free operation.

Loafing Btu's produce no



This installation of Bailey Boiler Control on five boilers fired by spreader type stokers insures fuel economy, safety of operation, and continuity of service. These 150 psi, 60,000 lb. per hr. capacity boilers supply steam for heating the various buildings of a large institution.

Branches in: Boston, New York, Schenectady, Philadelphia, Buffalo, Pittsburgh, Cleveland, Detroit, Cincinnati, Atlanta, Chicago, Milwaukee, St. Louis,



power

You find loafers everywhere. Even in a collection of Btu's. You have to *make* them work if you expect to get low cost power. And that is exactly what the Bailey co-ordinated boiler control system is designed to do.

It reduces fuel consumption per pound of steam generated. Combustion, feed water, steam temperature, heater levels, pump speeds and other factors are co-ordinated. Safety of operation is increased — continuity of service is improved. You convert the maximum number of Btu's into power and get all the efficiency your boiler was designed to deliver.

One thing to remember, however, is the fact that this Bailey system is **not** delivered in a standard package. Each one is designed and engineered to the specific job on which it is to be used. That's *why* it functions so efficiently.

If you are looking for low cost power, it will pay you to call our nearest office.

BAILEY METER COMPANY
1036 IVANHOE ROAD · CLEVELAND 10, OHIO
BAILEY METER COMPANY LIMITED, MONTREAL, CANADA

BAILEY METERS

Controls for Steam Plants

COMBUSTION · FEED WATER · TEMPERATURE
PRESSURE · LIQUID LEVEL · FEED PUMPS

A-104-2

New Orleans, St. Paul, Kansas City, Houston, Denver, Los Angeles, Seattle, San Francisco • Halifax, Montreal, Toronto, Winnepeg, Vancouver

Can you hang this sign on your turbines?

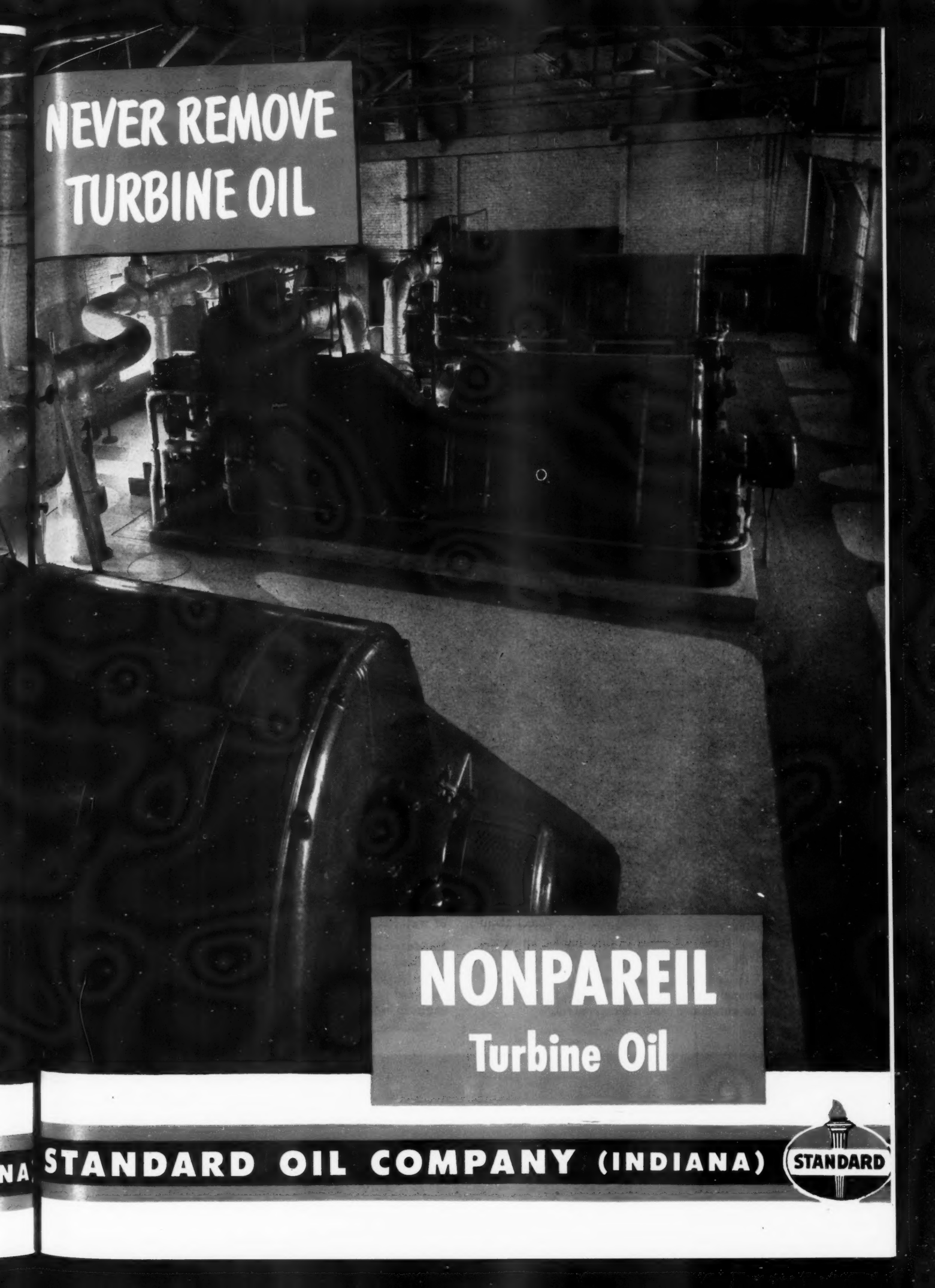
Could the oil in your turbines today be left there for the next 10 or 15 or 20 years without removal for treating, resting, or cleaning the oil system? Yes, if it were Nonpareil Turbine Oil. For instance, take Nonpareil's operating record in the midwest utility plant shown at right.

Nonpareil was put into three 5,000 KW General Electric turbines in July 1932, November 1934, and November 1940, respectively. The first fills of Nonpareil have never been removed from the three turbines. In 16 years' operation in one unit, Nonpareil maintained an average neutralization number of .06 mg. KOH/gm. Because of low-acidity operation, there has been no need for treating oil or cleaning turbine oil systems.

Why risk dangerous acidity increase that can lead to the formation of harmful deposits and emulsions in turbine oil? Make your next fill Nonpareil Turbine Oil. It contains anti-corrosion and anti-foaming agents further to assure safe operation for the "life of your turbine."

Ask a Standard Oil Lubrication Engineer about the benefits of the written guarantee you receive with Nonpareil. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY (INDIANA


NEVER REMOVE
TURBINE OIL
NONPAREIL
Turbine Oil
STANDARD OIL COMPANY (INDIANA)
STANDARD

In YOUR industry there's a plant with your problems now using VU

You may feel that your steam generating requirements are unusual, or peculiar to your industry. Perhaps you are in the textile industry, a paper plant, a mine, or a brewery. You may be generating steam with pulverized coal for a utility station . . . or even burning crushed cane to produce process steam for a sugar refinery. Your needs may be as little as 15,000 lb of steam per hr, or exceed 300,000.

Yet, paralleling your problems, there is some similar plant profiting from VU performance. For, in every basic industry, the VU Unit has met the supreme test of use. Throughout the United States and Canada, Latin America and abroad, the VU has been selected for installations with an aggregate capacity of more than 80,000,000 lb of steam per hr. Spot check, in your own industry, the experience of others . . . see how the versatile VU Unit adapts itself to your *special* needs. B239

DOESN'T THIS DESCRIBE THE UNIT YOU WANT?

Adaptable — The VU Unit is adaptable to limited space conditions, to the use of any fuel or method of firing, and to widely varying requirements of load, pressure and temperature.

Efficient — The VU Unit operates at efficiencies up to 88 per cent, due to a basic design which combines efficient combustion, maximum exposure of evaporative surface to radiant heat, cross-travel of gases in tube banks, and concentration of large heating surface in the last bank.

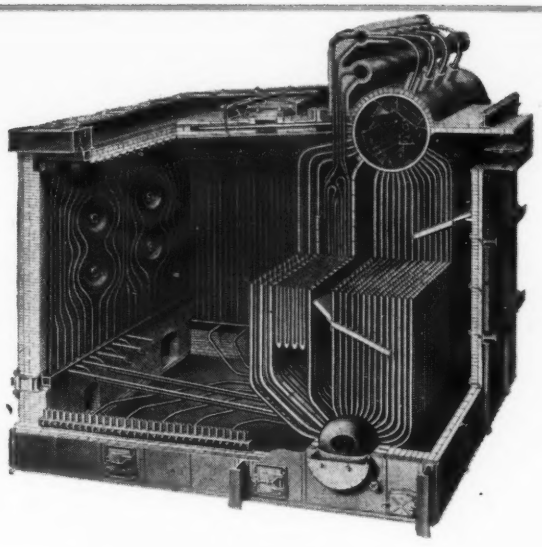
Flexible — The VU Unit may be operated over a wide range of output, is responsive to extreme fluctuation in load, and is well adapted to automatic combustion control.

Symmetrical — Symmetrical design of longitudinal sections eliminates lazy tubes, since each section has the same furnace volume, same evaporative surface, same amount of water, and produces the same amount of steam. Moreover, the uniform release of steam along the entire length of the drum eliminates surging water level and periodic carry-over of water slugs.

Standardized — Details, as well as general design, are standardized — a safeguard against errors or oversights in manufacture and installation. And the economies of standardized design are reflected in first cost, since much of the engineering of individual units is avoided.

COMBUSTION

C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

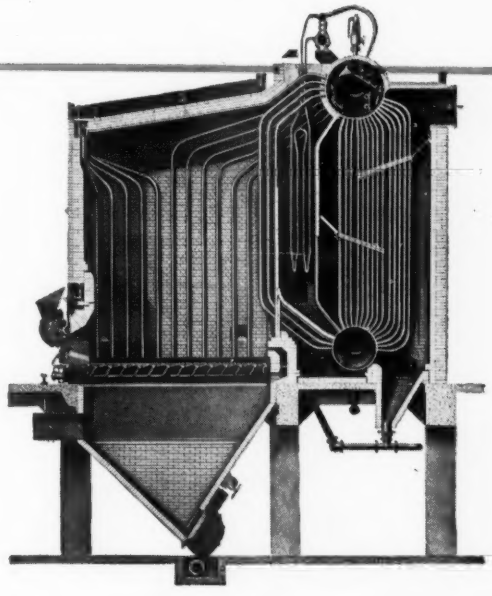


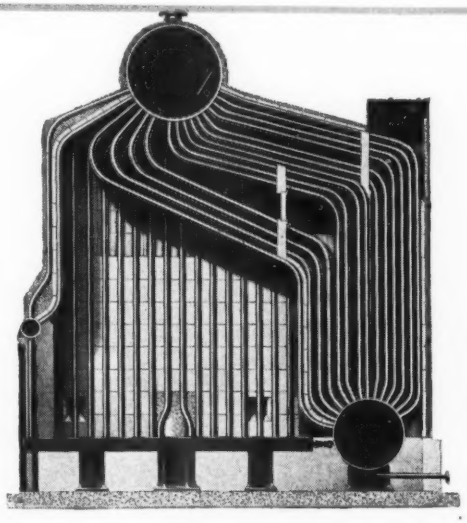
Type VU Steam Generator
(for the higher capacity range)

This unit, the original VU design, may be fired by pulverized coal, oil or gas, or any combination of these fuels. Available for capacities up to 350,000 lb of steam per hr, pressures up to 1000 psi and steam temperatures up to 900 F, or higher. Furnace bottom may be as shown or may be of hopper type. Economizer or air heater surface may be added.

Type VU Steam Generator
(for the middle capacity range)

In this VU design, shown equipped with a C-E Spreader Stoker, the furnace proportions and arrangement of water wall surfaces may be adapted for firing by any type of mechanical stoker. Design is also adaptable for firing by oil or gas. Economizer or air heater surface may be added. Approximate capacity range 25,000 to 100,000, or more, lb per hr.





C-E Package Boiler
(for the lower capacity range)

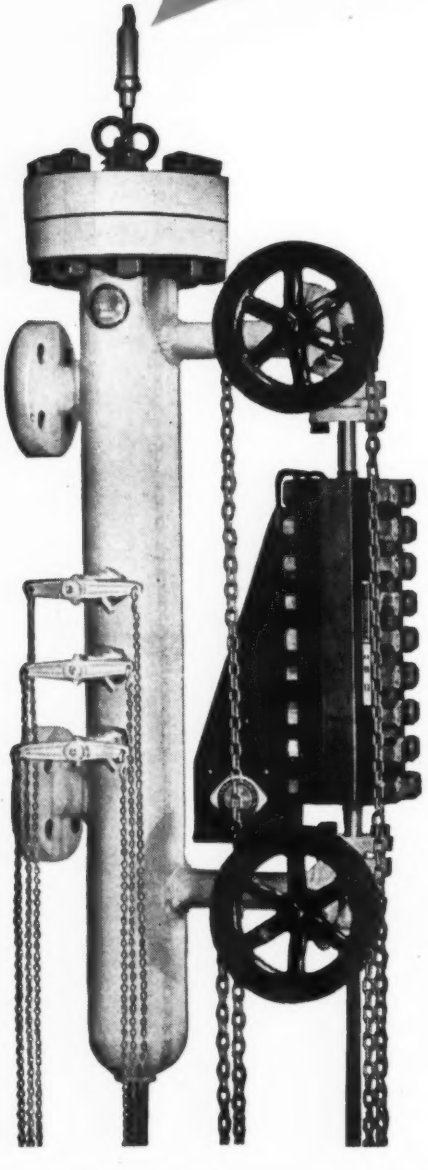
This youngest member of the VU family is designed for industrial load conditions and particularly for plants having small operating and maintenance forces. Capacities range from about 15,000 to 50,000 lb per hr. Firing may be by spreader stoker, single-retort underfeed stoker, oil or gas burners. Any of these methods may be substituted for any other, should fuel market conditions make this desirable.

ENGINEERING
200 MADISON AVENUE, NEW YORK 16, N. Y.

One

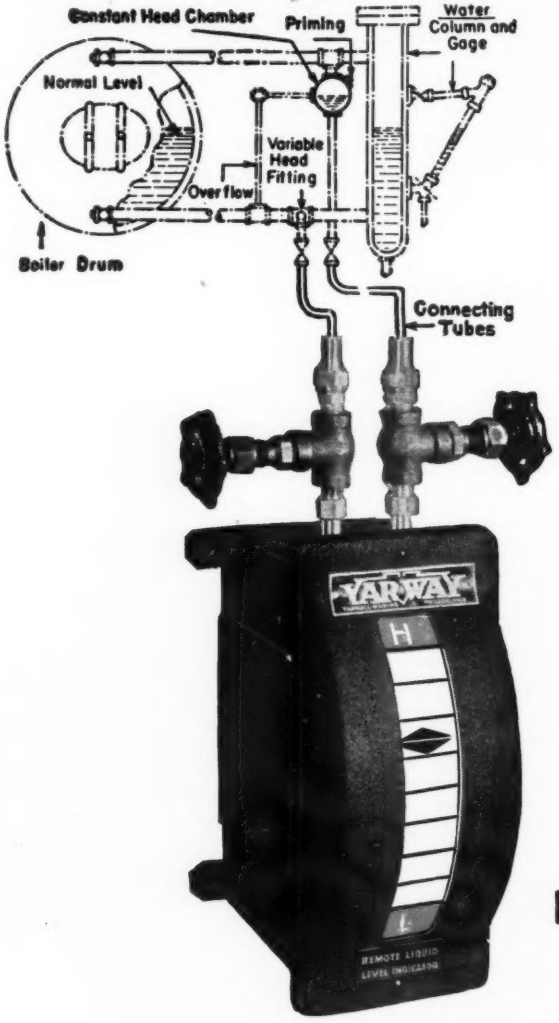
WHEN YOU BUY

YARWAY WATER COLUMNS AND GAGES



A

YARWAY REMOTE BOILER WATER LEVEL INDICATORS



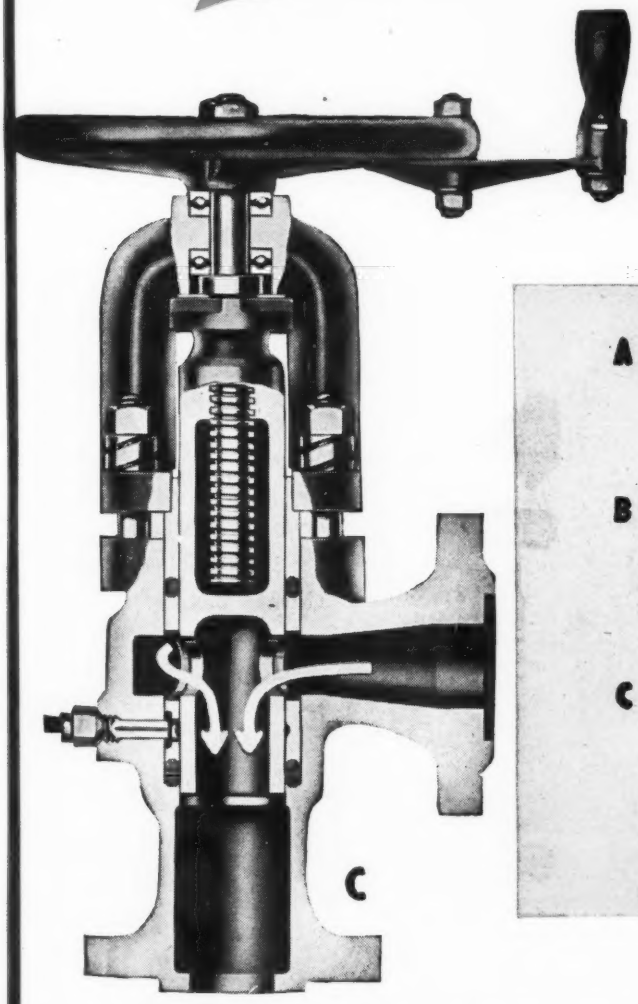
B

YARWAY

RESPONSIBILITY

all 3 FROM YARWAY

YARWAY BLOW-OFF VALVES



Power plant engineers may simplify responsibility by insisting that all three of these important boiler trim items be Yarway.

Why, you ask?

First, responsibility for the satisfactory performance of all three is centered in one company.

Second, Yarway's extensive service organization, with branches in principal cities in the United States and Canada, is conveniently at your service.

Third, each product has an outstanding feature—an *engineering reason,* laboratory-tested and field-proved for better performance.

For more complete facts on these and other products in the Yarway line of steam plant equipment, write for Yarway's all-products Catalog G-1306.

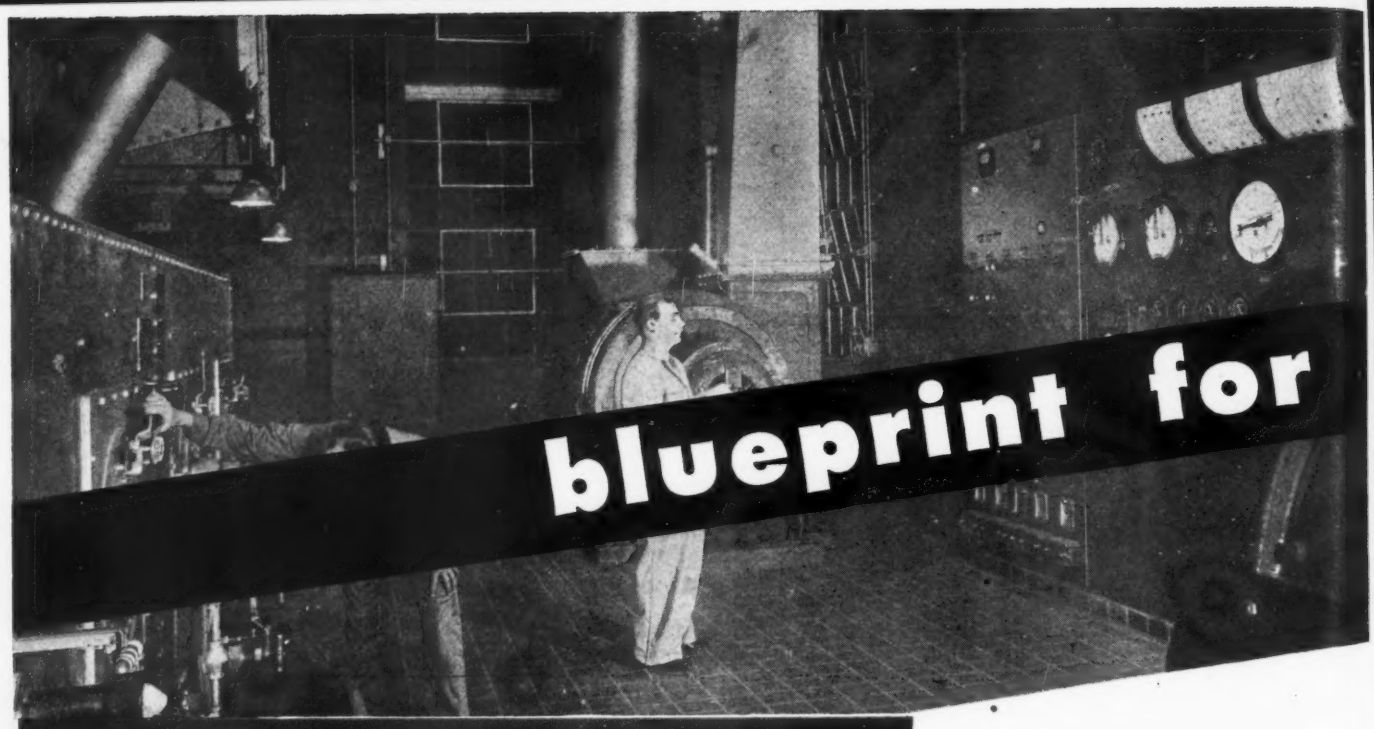
YARNALL-WARING COMPANY
100 Mermaid Ave., Philadelphia 18, Pa.

A — Yarway Hi-Lo Alarm *Floatless* Water Column with patented Yarway Flat Glass Gage featuring a "floating assembly" that practically eliminates glass breakage. For pressures from 400 to 2500 psi. Other Yarway Columns and Gages for lower pressures. Write for Yarway Bulletin WG-1811.

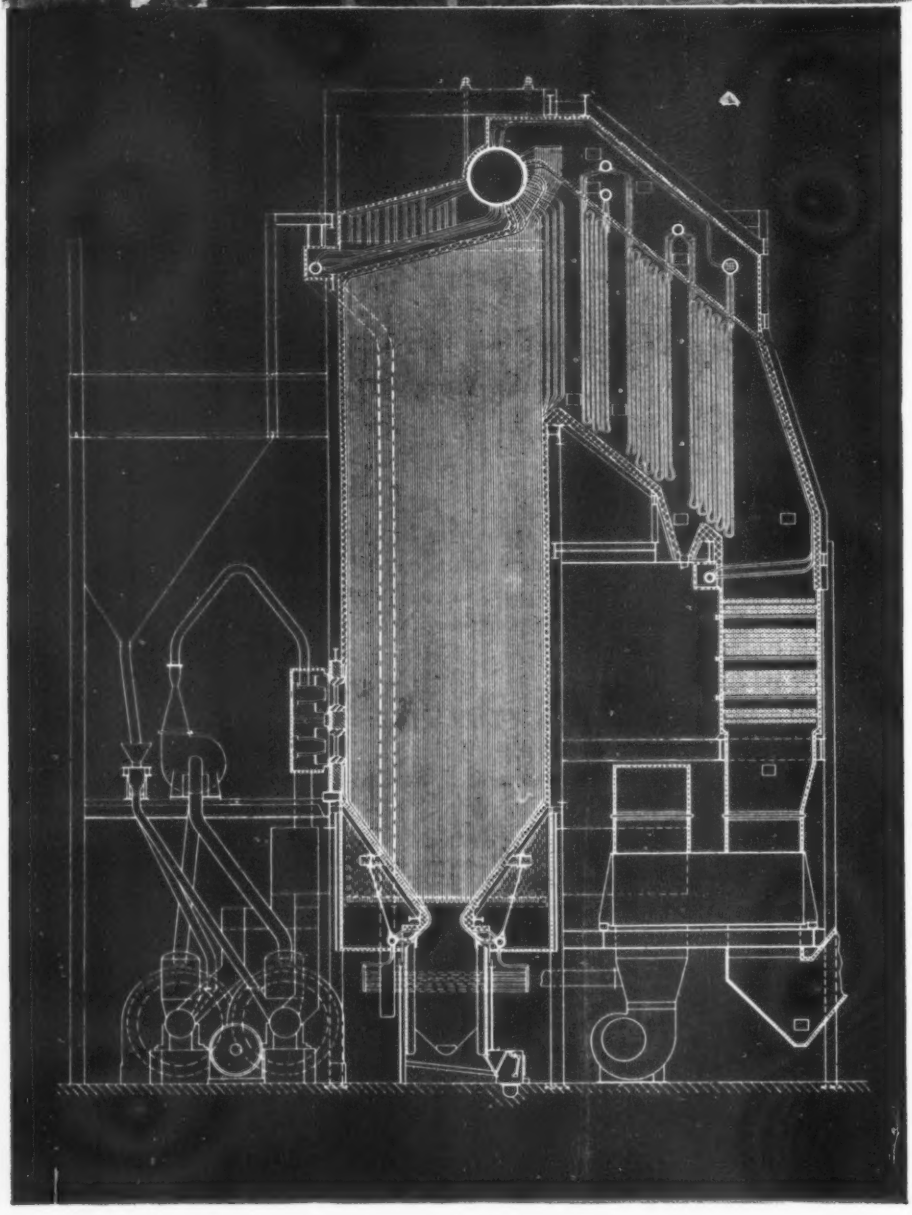
B — Yarway Remote Boiler Water Level Indicator that brings overhead readings right down to eye level, on instrument panel or other convenient place. Always accurate because it's operated by the boiler water itself. Action is instant, constant. No *stuffing boxes.* Moderate in price. Easy to install. For all pressures to 1500 psi. Write for Yarway Bulletin WG-1822.

C — Yarway Seatless Blow-Off Valve. No seat to score, wear and clog with mud, scale and dirt. Balanced sliding nitralloy plunger simplifies operation. Also furnished in Tandem, or as a Unit Tandem combined with a Yarway Hard-Seat Valve for highest pressures. Write for Yarway Bulletin B-424 for pressures to 400 psi; Bulletin B-432 for pressures to 2500 psi.

STEAM PLANT EQUIPMENT



blueprint for



E. M. POSTON STATION
COLUMBUS AND SOUTHERN OHIO ELECTRIC COMPANY

Steam Capacity
425,000 lb per hr

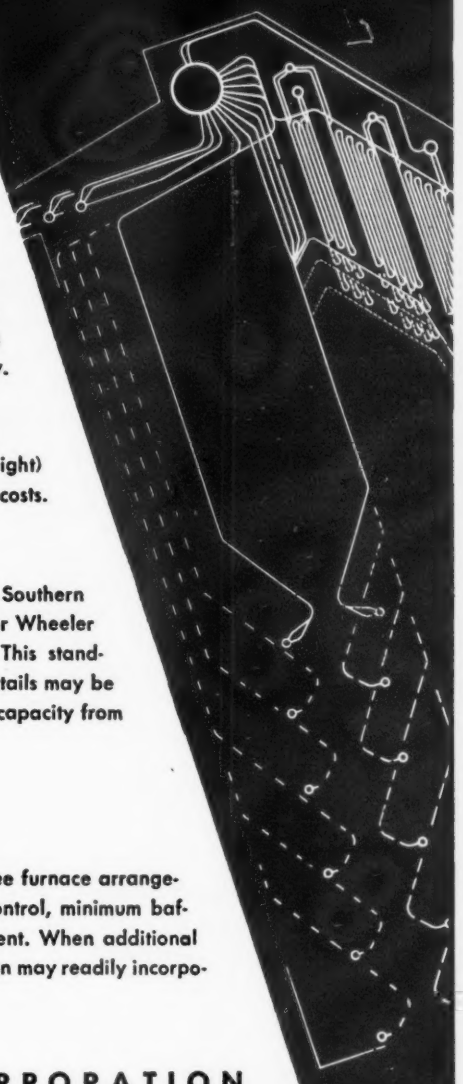
Superheat control range
300,000 to 425,000 lb per hr

Pressure superheater outlet
1354 psi

Final steam temperature
955 F

Bituminous Coal Pulverized
in FW Ball Mills

standardization



Standardized Steam Generating Equipment for Central Stations

Foster Wheeler has demonstrated outstanding leadership in developing central station equipment which helped the Utility Industry to achieve increased productivity. A large share of the credit can be directly ascribed to the FW line of single-pass, baffle-less steam generators having liberal furnace dimensions. This arrangement has been used as the basis for "Preferred Standard" steam generator designs which have been developed by Foster Wheeler Corporation for the Utility Industry.

Engineering and Manufacturing Costs Reduced

The "Preferred Standard" steam generator design (suggested on the right) promises substantial savings by the reduction of engineering and fabrication costs.

Fixed Individual Equipment Details

The unit being built for the E. M. Poston Station of the Columbus and Southern Ohio Electric Company is typical of the single-pass design which Foster Wheeler is using as the basis for "Preferred Standard" steam generators. This standardized steam generator pattern with fixed individual equipment details may be readily applied to a series of single or twin furnace units varying in capacity from 300,000 lb per hr to over 1,000,000 lb per hr.

Other Foster Wheeler Fuel and Labor Saving Features

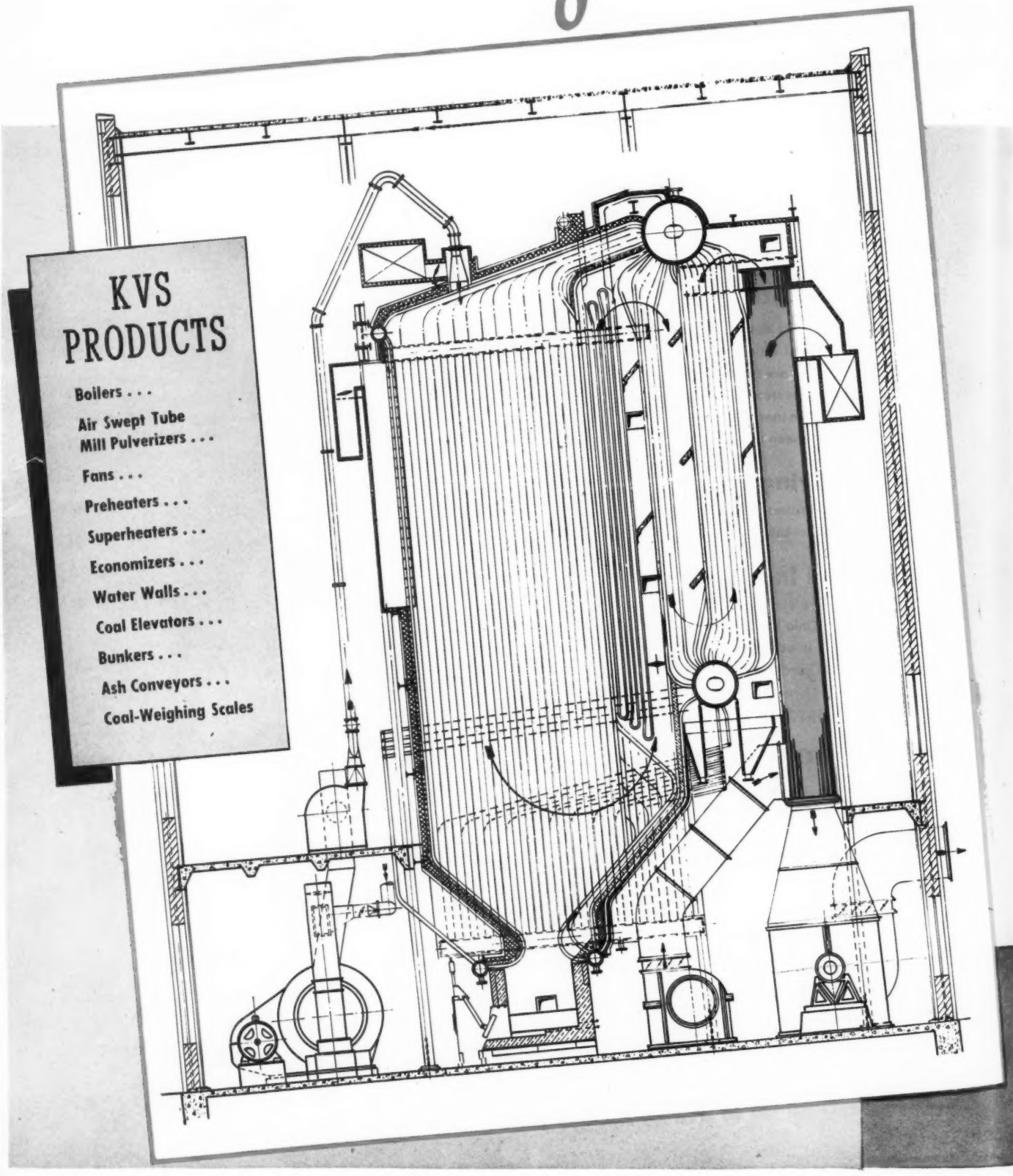
The design also embodies Foster Wheeler features of slag-free furnace arrangement, Foster Wheeler condenser-type steam temperature control, minimum baffles, low draft loss, and efficient heat recovery arrangement. When additional furnace cooling is required, the "Preferred Standard" design may readily incorporate a water cooled division wall.

For additional information, write . . .

FOSTER WHEELER CORPORATION
165 BROADWAY, NEW YORK 6, N. Y.

FOSTER WHEELER

KVS Engineered...



...PREHEATERS

Typical ACHIEVEMENTS • • • •

LOW Draft Loss
LOW Exit Temperature
CORRECT Secondary Air Temperature
HIGH Primary Air Temperature

Some of the important factors necessary for high overall efficiency in steam generators are proper mixing of primary air at the right temperature, superfine pulverization, and low exit gas temperature. All these conditions are met in KVS engineering of preheaters.

These components are of the downdraft gas and cross counterflow air type. Gas passes inside the preheater tubes and air outside. Design is such as to minimize draft loss and pressure drop. Gases having high sulphur content can be safely handled. An all metal, all welded casing is employed to assure tightness.

KVS Air Preheaters are designed and built for single or multi-pass gas and air. A liberally dimensioned soot hopper is provided at the turn of the gases and arranged to collect fine precipitate which is removed by an automatic ash handling system.

Ducts for connecting fans to preheater and from preheater to burners and pulverizers are of proper size and proportion for the service and are designed to accommodate expansion and application of insulation.

We have not featured KVS Air Swept Tube Mills with automatic controls here, because we believe the industry recognizes their superiority.

These and all other components of KVS Steam Generating Units are engineered to meet specific operating conditions on available fuels in order to assure the maximum in operating efficiency and economy at all boiler ratings.

KVS ENGINEERING SERVICE

KVS Steam Generating Equipment has been performance proved over the years. KVS offers a complete service in design, building and erecting complete plants under one responsibility. KVS engineers are available for consultation on your requirements.

Ask for a copy of 97-page Engineering Bulletin No. 44-B containing valuable information on preparation of pulverized fuel and steam generating plants.

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Consider the figures

When you buy a combustion control system, only the first cost is in the bid—and you have to look *beyond* first cost to know which system is your "best buy."

Let's take the matter of depreciation, for example. Not depreciation as an arbitrary figure for the convenience of the accounting department, but as a measure of the useful and efficient life of the equipment. The ruggedly built components of the Hagan system last as long as the boiler—and longer.

How much will maintenance cost you? Surprisingly little—with Hagan. Simplicity of design is a major factor here, and Hagan equipment is designed to give minimum opportunity for wear, to use the fewest possible parts which may get out of order, to make maintenance easy. As one old-timer put it: "You don't have to be no watchmaker to work on Hagan controls."

that aren't in the bid——

All of these figures on costs, however, are far less important than figures on fuel. Take for example a 100,000 lb./hr. boiler, running 24 hours a day, 300 days a year. Coal consumption will be roughly 5 tons an hour. At $6.00 a ton, your fuel bill will be $720.00 a day, $216,000 a year. Such a boiler will consume a million dollars worth of fuel in less than five years—and five years is only a fraction of the useful life of boiler and control.

Figures like this make it clear that the really important thing is not the cost of the control system, but what that system will do to your fuel costs—and that brings you right back to Hagan.

Hagan equipment lasts as long as the boiler, stays accurate, and gives you dependable, trouble-free service as long as it lasts.

Our engineers are at your service.

Hagan Corporation, Hagan Bldg., Pittsburgh 30, Pa.

HAGAN CORPORATION

HAGAN
HALL
BUROMIN
CALGON

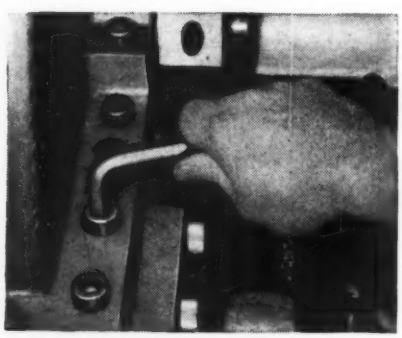
BOILER COMBUSTION CONTROL SYSTEMS
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
METALLURGICAL FURNACE CONTROL SYSTEMS
THRUSTORQ FORCE MEASURING DEVICES

YOU can enjoy greater dependability and less maintenance than ever before when you power your drives with the new Type DP turbine. The superior design features that make this possible are all standard equipment—yours at no extra cost.

If you have steam available, these *new* turbines can work profitably for you. G-E sales engineers and turbine specialists will be glad to show you how your equipment can benefit from the features of G-E turbine drive. And, their wide experience is at your disposal.

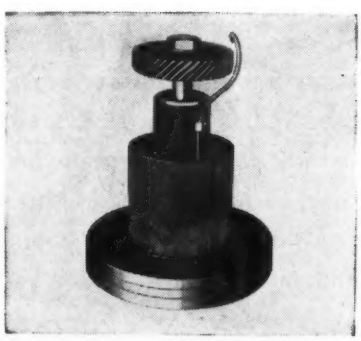
For full information please contact the nearest G-E Apparatus Sales Office. Or, write today for GEA-4955, a fully illustrated, 20-page descriptive bulletin. Apparatus Department, General Electric Company, Schenectady 5, N. Y.

HERE'S HOW THE NEW SAVES YOU



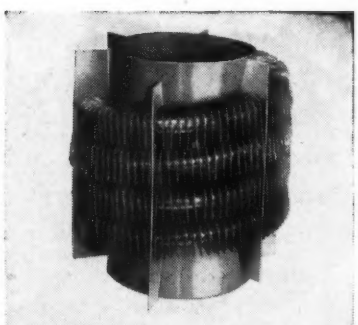
DISASSEMBLY IS EASY

Convenient socket-head cap screws replace the conventional casing bolts on the Type DP. Thus disassembly is quick and easy.

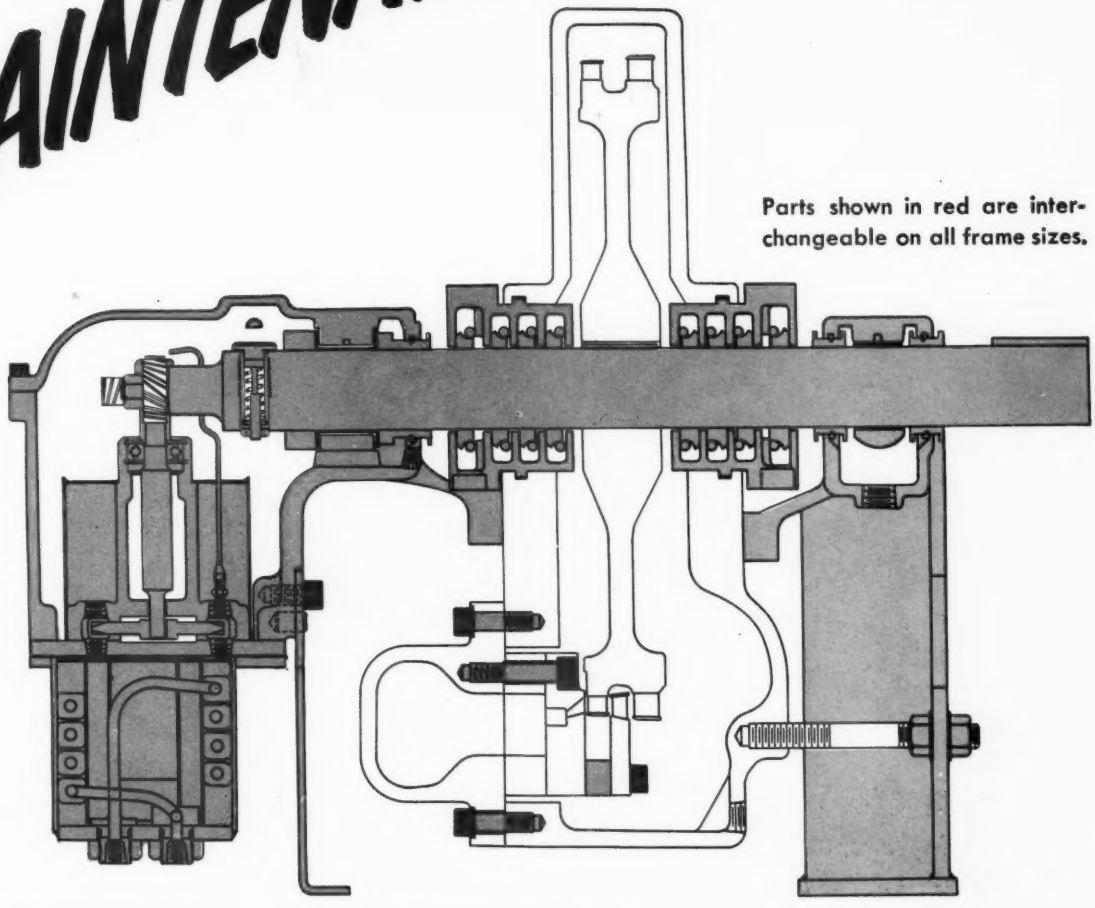


NO LUBRICATION WORRIES

A turbine-type pump, gear-driven from the turbine shaft, assures positive lubrication. An easily removable oil cooler provides adequate cooling of bearing oil. The bearings themselves are the new solid-backed type, will wear better, last longer. Thrust surfaces fix rotor position.



TURBINE DRIVE MAINTENANCE DOLLARS



Parts shown in red are interchangeable on all frame sizes.

STANDARDIZED PARTS

Interchangeability is a Type DP feature. This permits lower cost, faster shipment of spare parts. You can reduce your spare parts inventory with a standard kit, containing parts applicable to all Type DP turbines.

IMPROVED GOVERNOR

The hydraulic governing system offers more than advantages in performance. It eliminates such governor elements as push rods, thrust bearings, knife-edges, etc., which are subject to wear and maladjustment.

EASIER MAINTENANCE

Individual components—cooler, oil pump, strainers, etc.—are readily accessible. The governor and emergency governor are totally enclosed in an oil atmosphere, eliminating rusting and sticking after standby.

GENERAL ELECTRIC

NAVCO
PROVIDES THE
POWER ARTERIES
IN THIS
CENTRAL STATION
Just another modern High Pressure-High Temperature Power Plant in the Southwest that has DEPENDABLE Piping.
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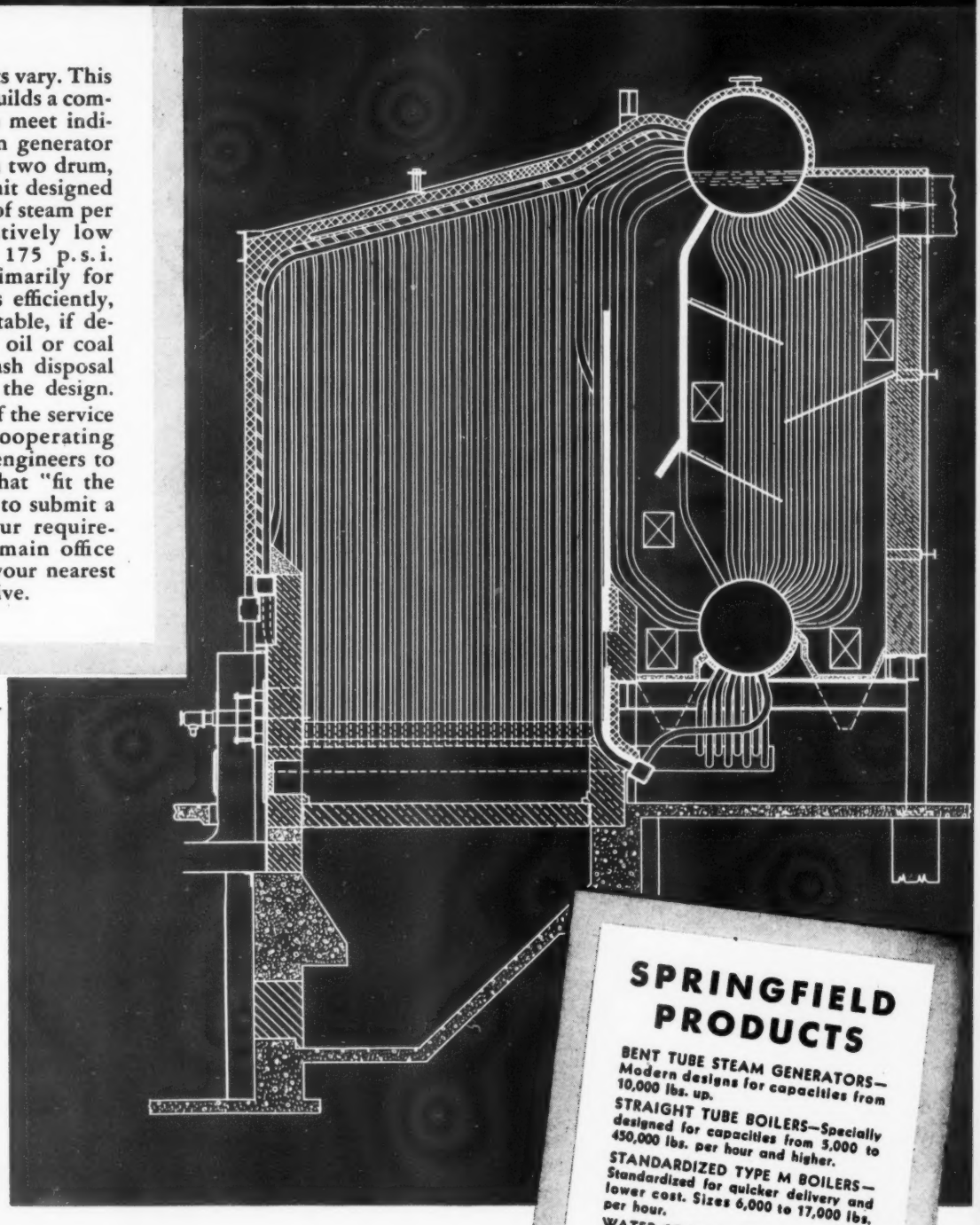
NAVCO PIPING
NATIONAL VALVE & MANUFACTURING COMPANY • PITTSBURGH, PA.
NEW YORK • CHICAGO • CLEVELAND • BOSTON • ATLANTA • TULSA • BUFFALO • CINCINNATI

GAS, OIL, OR COAL FIRING

BOILER requirements vary. This is why Springfield builds a complete line of boilers to meet individual needs. The steam generator shown here is a modern two drum, bent tube Springfield unit designed to produce 40,000 lbs. of steam per hour at the comparatively low working pressure of 175 p.s.i. Although planned primarily for burning coke oven gas efficiently, it is also equally adaptable, if desired, to conversion to oil or coal firing—provision for ash disposal being incorporated in the design.

This is an example of the service Springfield offers in cooperating with the user and his engineers to produce installations that "fit the job!" We will be glad to submit a proposal covering your requirements. Write to our main office in Springfield, or see your nearest Springfield representative.



SPRINGFIELD PRODUCTS

BENT TUBE STEAM GENERATORS—Modern designs for capacities from 10,000 lbs. up.

STRAIGHT TUBE BOILERS—Specially designed for capacities from 3,000 to 450,000 lbs. per hour and higher.

STANDARDIZED TYPE M BOILERS—Standardized for quicker delivery and lower cost. Sizes 6,000 to 17,000 lbs. per hour.

WATER COOLED FURNACES—Heavy duty water walls. Exclusive center water wall construction for larger units.

SUPERHEATERS — AIR HEATERS — ECONOMIZERS—Individually designed to meet requirements.

CHECK WITH YOUR CONSULTING ENGINEER ON YOUR MODERNIZATION AND NEW PLANT PROJECTS.

SPRINGFIELD BOILER CO.

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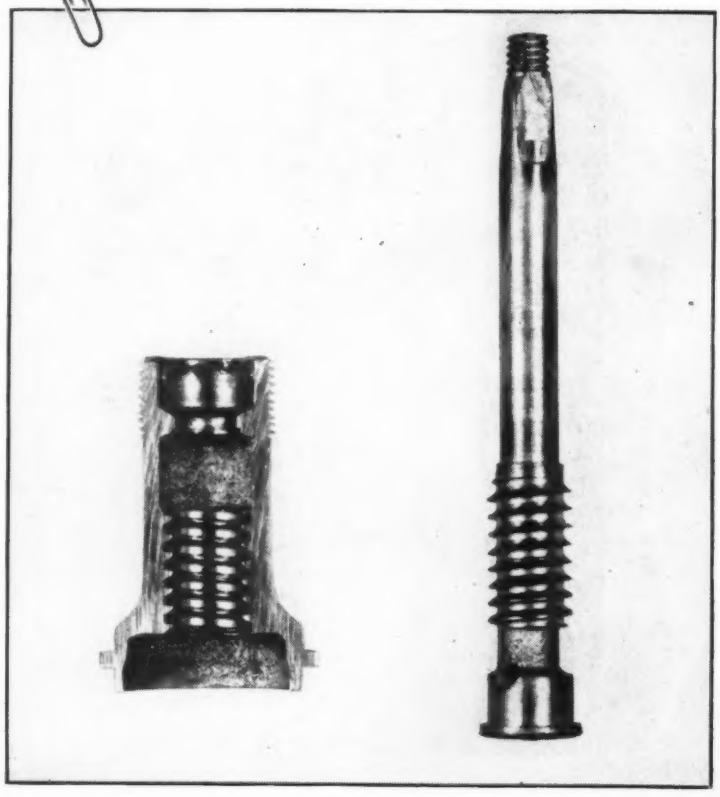
...in actual service



Un-retouched photo showing result of one of many wear tests. Lunkenheimer—Fig. 73 "Renewo" Globe Valve test stopped at 305,000 cycles (open and close). Stem still working well although partially worn. ***All Lunkenheimer bronze stems, from the smallest to the largest, are made of this patented wear-resistant alloy.***

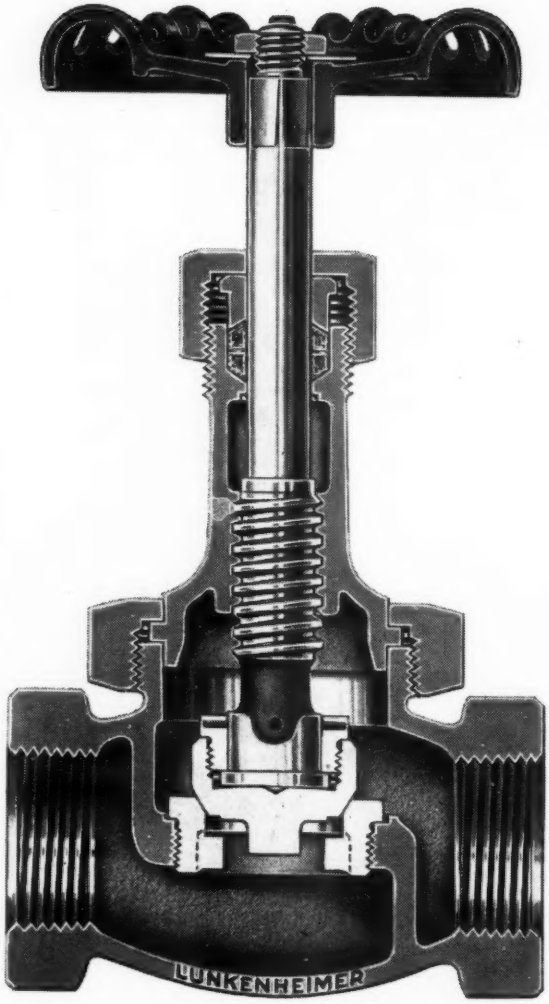


Fig. 73 "Renewo" Globe Valve

LUNKENHEIMER VALVES

MILLIONS OF LUNKENHEIMER VALVES IN SERVICE without a single report of stem thread failure due to wear

FOR many years, stem-thread wear was a major source of valve failures. Corrosion and especially dezincification, also frequently caused failures. With traditional resourcefulness, LUNKENHEIMER research developed two new stem alloys (Symbols RSB and Alloy 6) which completely revolutionized all prior conceptions of stem serviceability (patent granted).

Before submitting this revolutionary development to the trade, laboratory tests of valves under severe operating conditions were conducted with these and many other possible materials. In every test, LUNKENHEIMER alloy stems outlasted others by wide margins.

Today, out of the millions of LUNKENHEIMER Valves equipped with these exclusive alloy stems, not one has been returned because of stem-thread failures due to wear. Serviceability in other respects has had comparable improvement.

What does this mean to you, as a valve user? By eliminating one cause of your valve trouble, LUNKENHEIMER assures you far greater service life with even less maintenance cost.

YOUR LUNKENHEIMER DISTRIBUTOR

will gladly explain in detail the many advantages of this patented and exclusive stem material. Ask him about LUNKENHEIMER Alloy Bronze Valve Stems.

ESTABLISHED 1862

THE LUNKENHEIMER CO.

"QUALITY"

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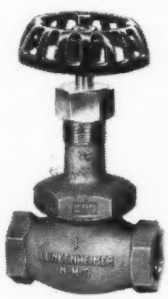


FIG. 123
N.M.D. Globe Valve

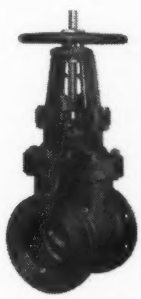


FIG. 1430
Iron Body Gate Valve

FIG. 2125
125 lb. S.P. Bronze Gate Valve

FIG. 2150
150 lb. S.P. Bronze Gate Valve

FIG. 2228
200 lb. S.P. Union Bonnet Gate Valve

FIG. 1640
King Clip Gate Valve

NOW YOU CAN

CONDENSE OR COOL

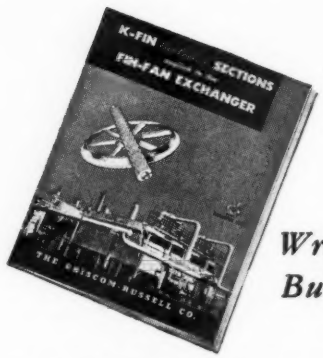
WITHOUT WATER

WITH THE FIN-FAN AIR-COOLED *Heat Exchanger*

AIR . . . not water . . . is the cooling or condensing medium in the FIN-FAN Heat Exchanger. With this unit, you avoid all the complications and expenses of a water supply system . . . no water piping, pumps, treatment, disposal or make-up; no corrosion, scaling, freeze-ups, or structural repainting due to use of water.

In the FIN-FAN Exchanger you have a unit that is simple, easy and economical to operate and that may be placed in any convenient location. It can be used to condense vapors or to cool gases and liquids at pressures up to 5000 psi and temperatures up to 1500°F., and its effectiveness is independent of the velocity or direction of the wind. In addition, one of its special advantages is that a single installation can be arranged to handle multiple duties.

Be sure to investigate the possibilities for your own plant in this exchanger of many applications and many benefits. Complete information sent on request.



Write for Bulletin

G-R Bulletin 1230 fully describes the design, construction and features of this important development in heat exchangers, jointly developed by Fluor Corporation, Ltd., and The Griscom-Russell Co. Write for your copy today.

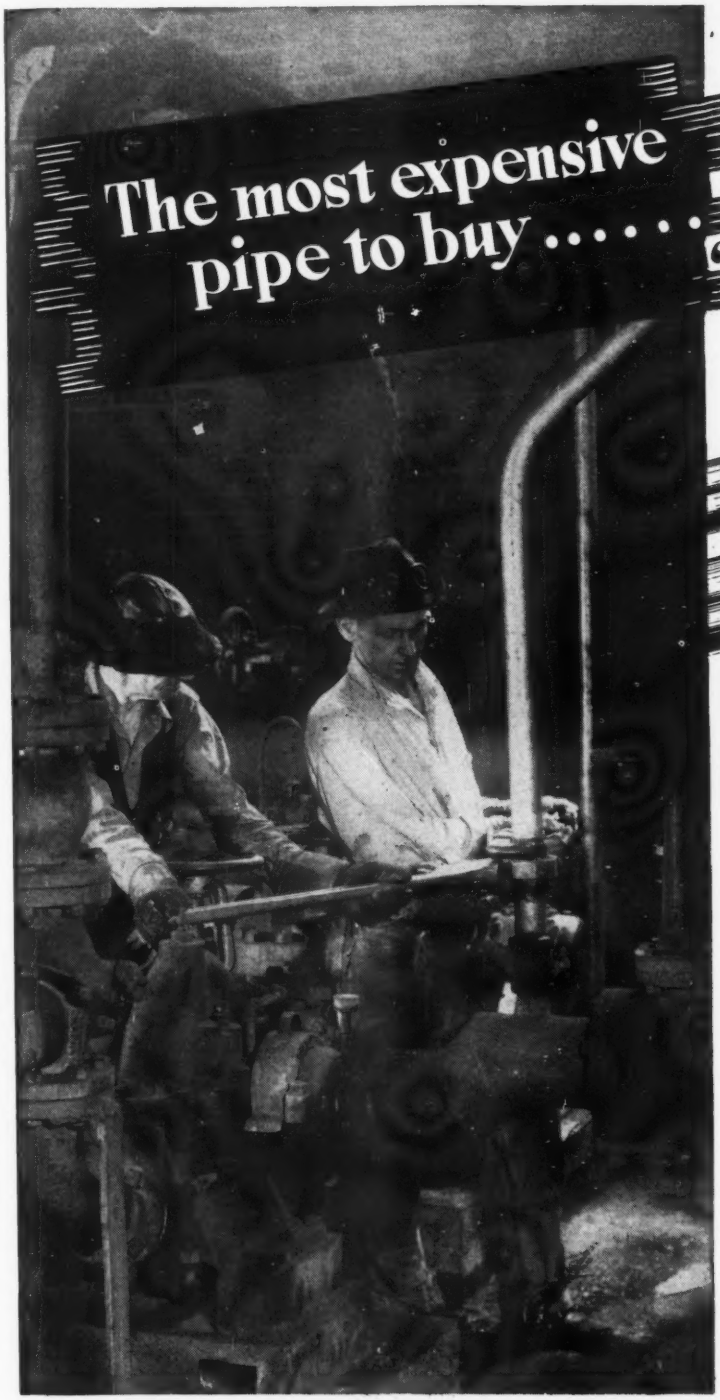
THE GRISCOM-RUSSELL CO.
285 MADISON AVENUE • NEW YORK 17, N. Y.

GR-193

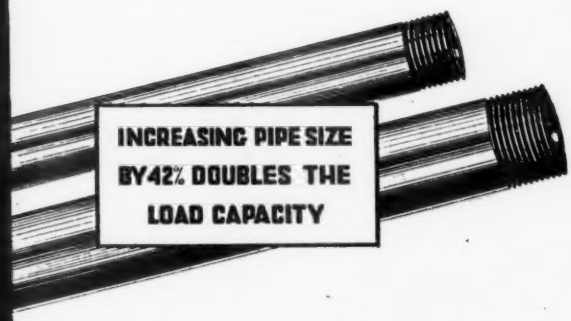
GRISCOM-RUSSELL

Pioneers in Heat Transfer Apparatus

INSTALL STEEL PIPING ADEQUATE FOR TOMORROW'S NEEDS

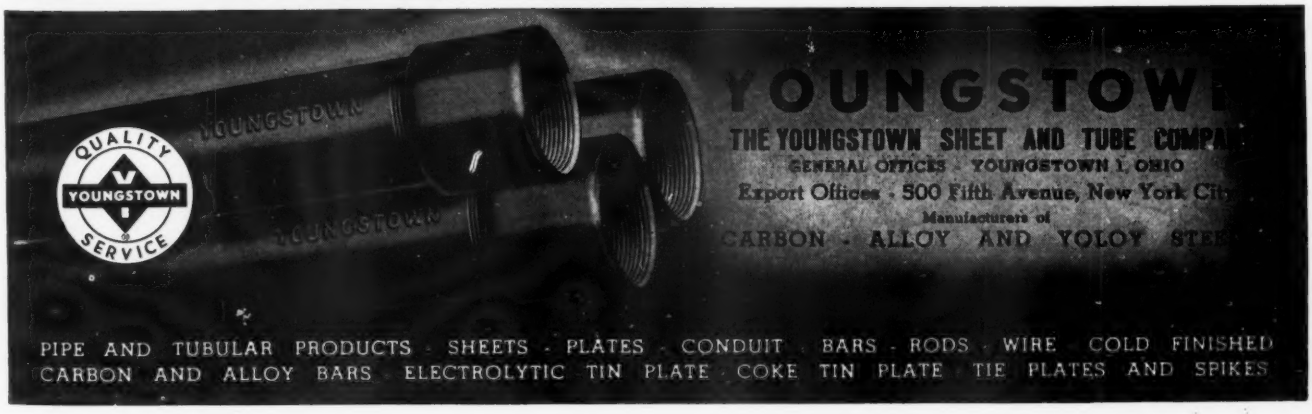


... is the pipe that's "just big enough"



THE wise builder buys steel pipe as an investment for tomorrow, as well as for today. He doesn't figure on the smallest size he can "get by" with. He projects water and steam and other production loads as far into the future as he can, and anticipates his pipe requirements accordingly.

Youngstown would rather supply you with adequately sized steel pipe today, than to sell you undersized pipe now and a replacement job later. Youngstown steel pipe is sold by leading distributors in every market.


QUALITY
YOUNGSTOWN
SERVICE
YOUNGSTOWN
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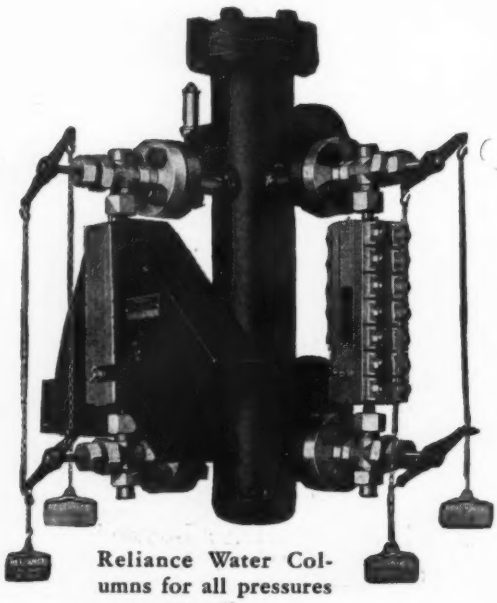
THE YOUNGSTOWN SHEET AND TUBE COMPA
GENERAL OFFICES · YOUNGSTOWN 1, OHIO
Export Offices · 500 Fifth Avenue, New York City
Manufacturers of
CARBON · ALLOY AND YOLOY STEE
PIPE AND TUBULAR PRODUCTS · SHEETS · PLATES · CONDUIT · BARS · RODS · WIRE · COLD FINISHED
CARBON AND ALLOY BARS · ELECTROLYTIC TIN PLATE · COKE TIN PLATE · TIE PLATES AND SPIKES

Guard Your Power

with Reliance Safety Water Columns and Gages

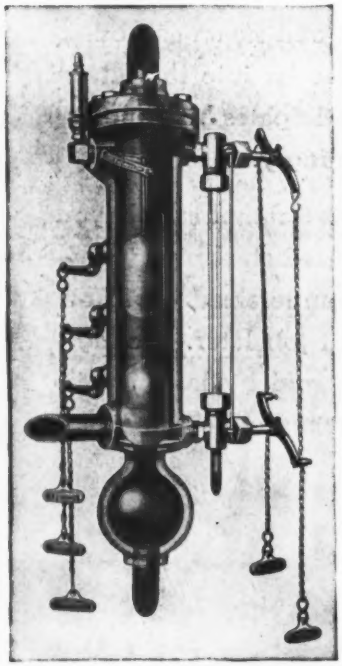


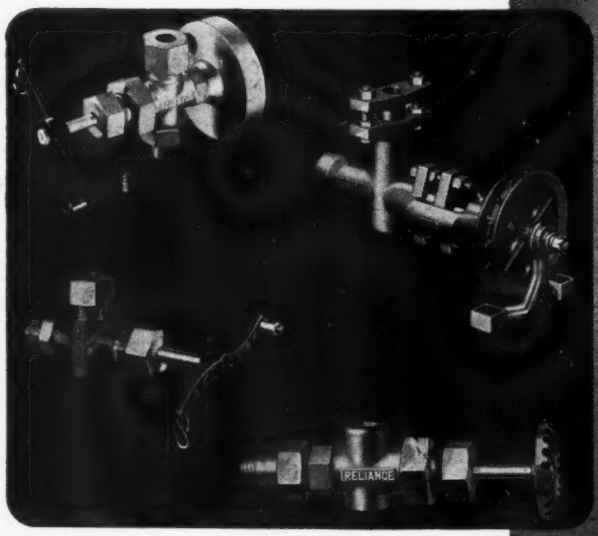
Reliance Water Columns for all pressures up to 2000 lbs.

• In spite of careful employee training and frequent warnings, low water level is still a common cause of serious boiler damage. Guard against power interruptions with ample means of checking water levels—even to having *extra* checks and signals to guarantee instant attention to approaching dangerous conditions.

Reliance Boiler Safety Devices include all the elements of safe water level supervision. Known the world over for sturdiness, accuracy and dependability, Reliance ALARM Water Columns are available for any pressure, and gage equipment to suit every water level checking need. Recently added are electric signal-actuating devices for main boiler and other water-containing vessels . . Reliance Representatives in all principal cities willingly help you to select the most suitable equipment for your needs.

Remote reading water level indication, so you can have a handy, easy-to-see gage on your instrument panel, is provided by Reliance EYE-HYE. Write for Bulletin—mention your working pressure.





Illustrated above are four types of Reliance Gage Valves. At right (center) Prismatic Gage Insert; also single and double-window Mica-Protected Flat Glass Inserts.

BOILER SAFETY DEVICES since 1884

Reliance

THE RELIANCE GAUGE COLUMN CO. • 5902 CARNEGIE AVENUE • CLEVELAND 3, OHIO

5.4 or 108 inch . . . every *Magic-Grip* Sheave is "Easy On . . . Easy Off!"

Largest Ever Built! This specially-built 108 inch *Magic-Grip* sheave was ordered for the same reason that thousands of smaller stock sheaves are ordered. It comes completely assembled . . . goes on the shaft without a struggle . . . grips like a vise . . . and is just as easily removed! Stock *Magic-Grip* sheaves from 1 to 250 hp are available through your nearest Allis-Chalmers dealer or district office.

Get Magic-Grip Sheaves In "Pre-Engineered" Drives

New 144-page "Pre-Engineered" *Texrope* drive manual lists 22,000 economical stock drives from 1 to 150 hp — meets 90% of all V-belt drive requirements. Ask for Bulletin 20B6956. ALLIS-CHALMERS, MILWAUKEE. *Texrope, Super-7, Texsteel, Texdrive, Magic-Grip* and *Vari-Pitch* are Allis-Chalmers trademarks.

A 2430

A Complete Range of Products		
Super-7 V-belts	5 types . . . sizes to suit every power transmission job	
Texsteel, Texdrive, Magic-Grip	Sheaves in a full range of sizes and grooves	
Vari-Pitch Sheaves	Exact variations in speed — Stationary or Motion control	
Speed Changers	Speed variations up to 375% at the turn of a crank	

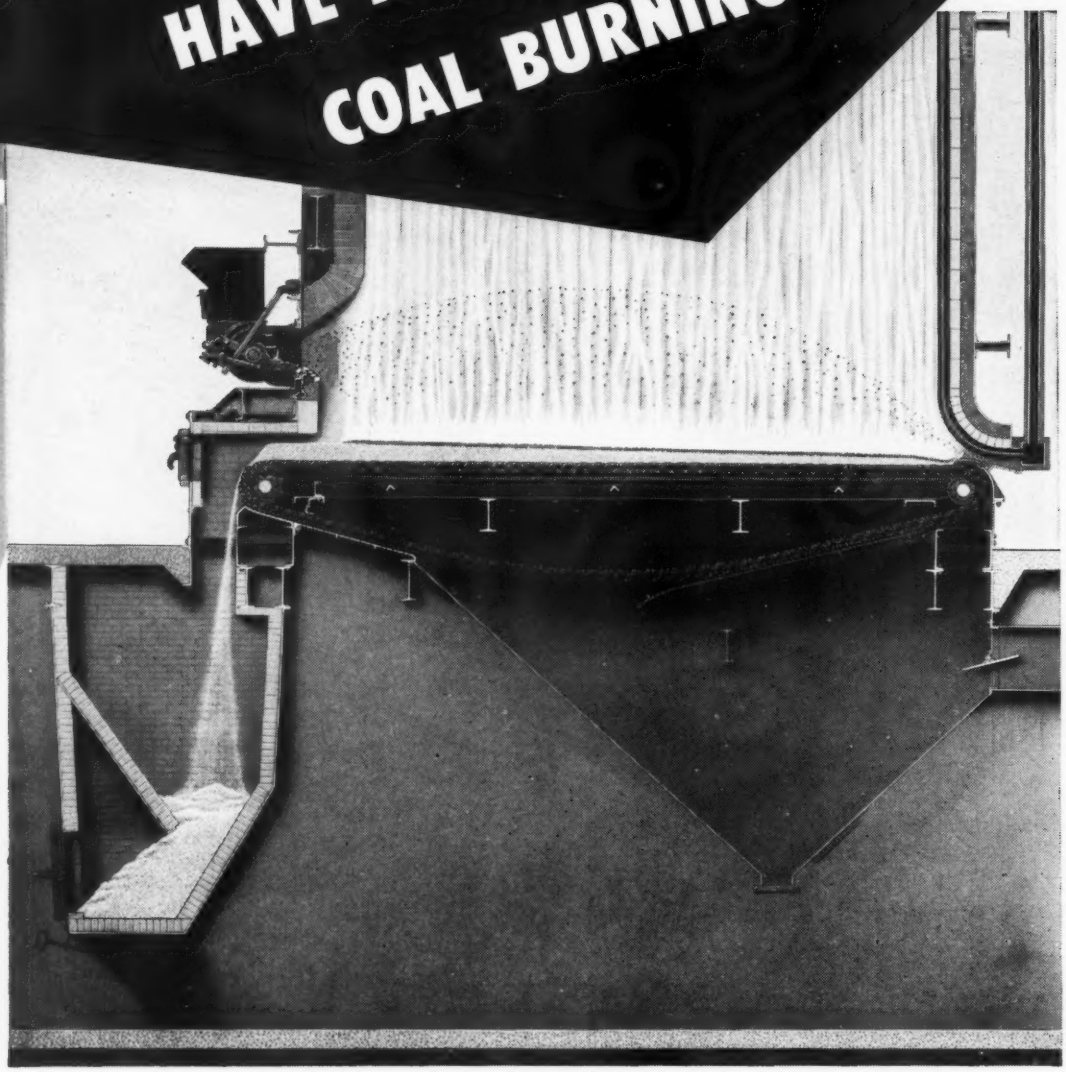
Texrope Super-7 V-belts result from the cooperative research of Allis-Chalmers and B. F. Goodrich; and are sold only by A-C dealers and offices.

ALLIS-CHALMERS

Originators of the Multiple V-belt Drive for Industry

In the Past 10 Years

DETROIT ROTOGRATE STOKERS HAVE REVOLUTIONIZED COAL BURNING

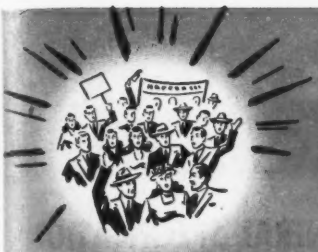


Grates move forward slowly and continuously, automatically regulated in proportion to the quantity of fuel being burned.

DETROIT STOKER COMPANY

GENERAL MOTORS BUILDING, DETROIT 2, MICHIGAN

WORKS AT MONROE, MICHIGAN • DISTRICT OFFICES IN PRINCIPAL CITIES



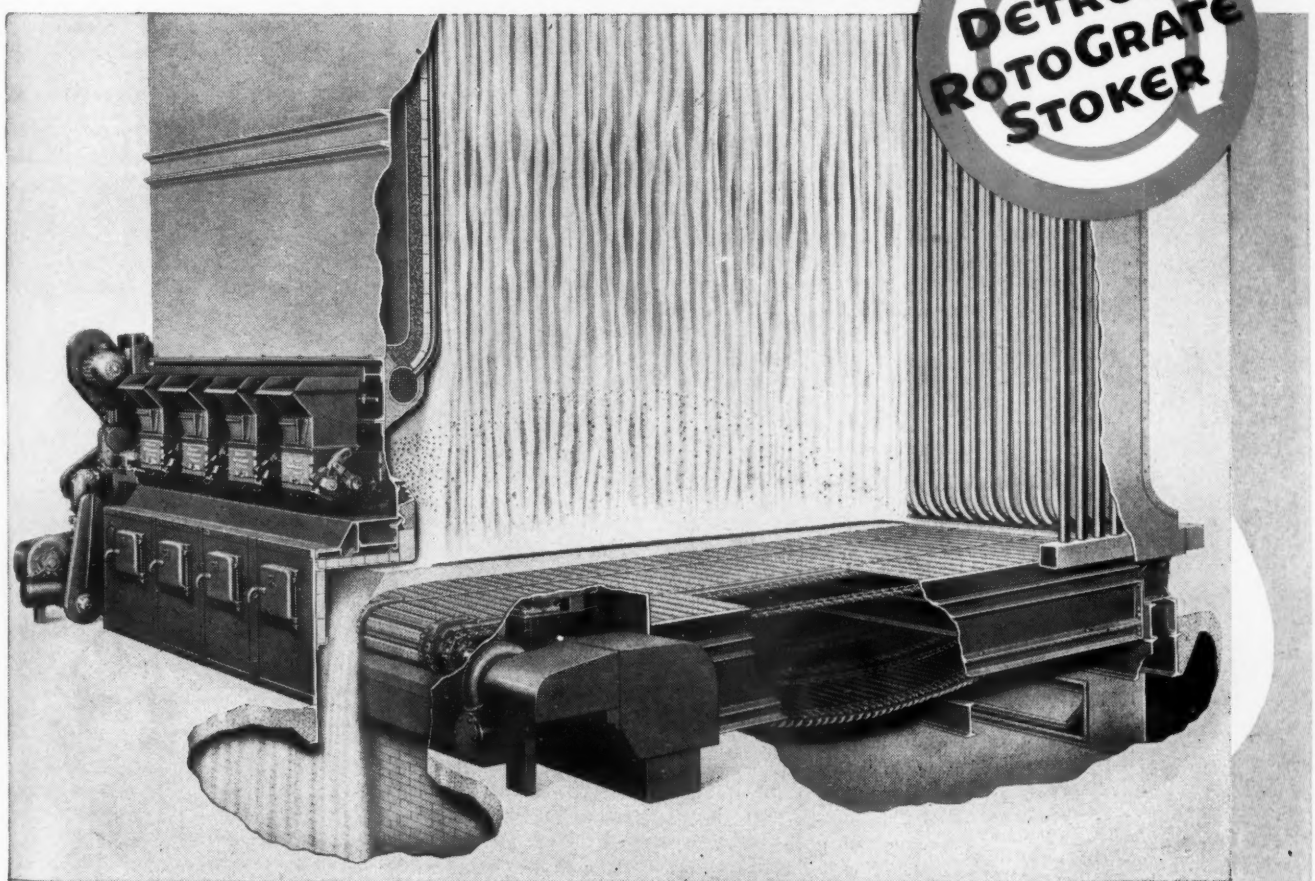
Elected by Popular Choice!

Several hundred Detroit RotoGrate Stokers are now installed or on order.

The successful record of the original forward moving, continuously cleaning spreader stoker.

Advantages Are:

- **Higher burning rates demanded by modern steam generators.**
- **Continuous operation for long periods.**
- **Operate with high CO_2. Preheated air may be used.**
- **Burn high or low grade coal or lignite.**
- **No clinker or slagging difficulties.**
- **Requires little power for operation.**

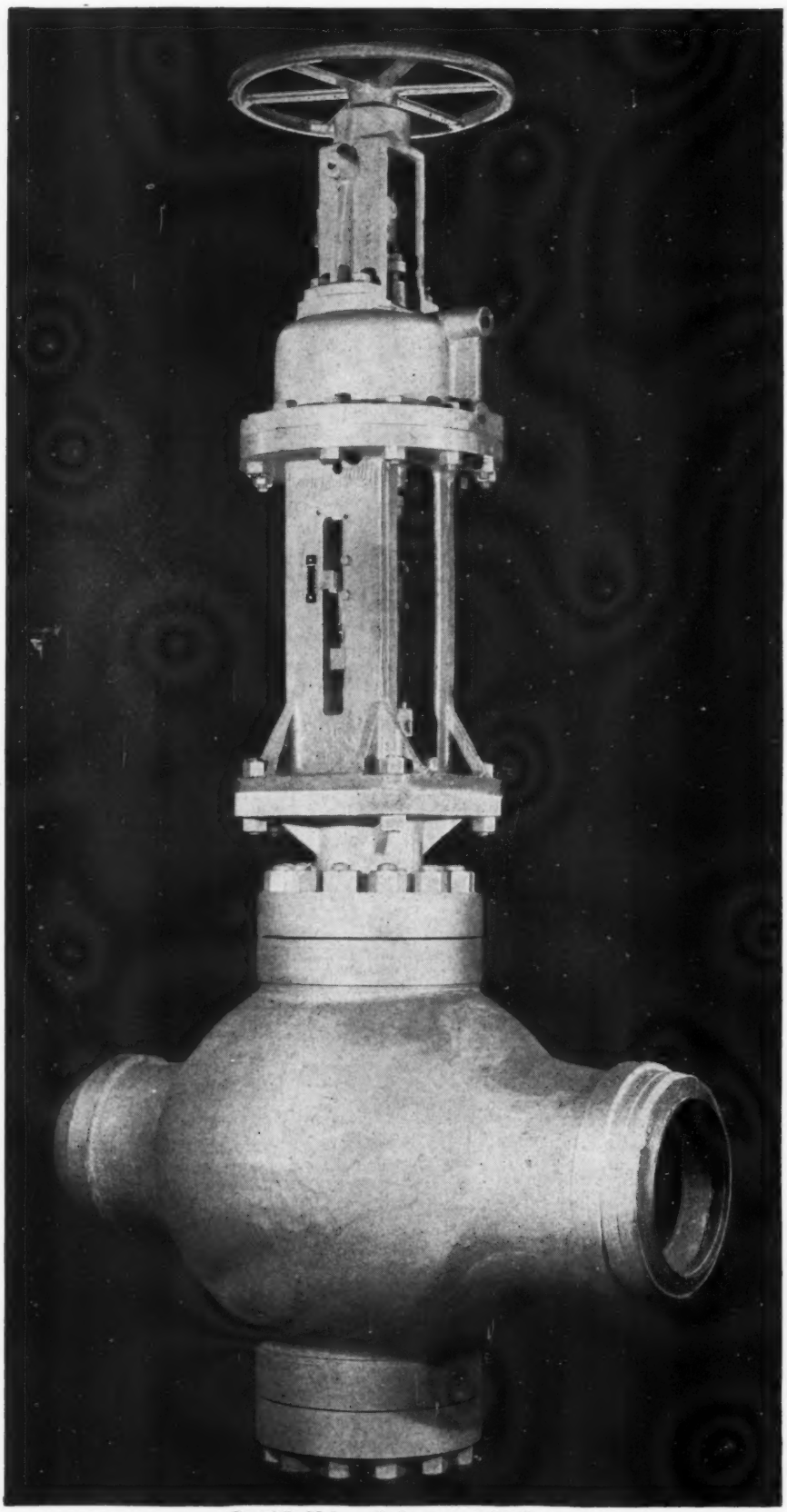


Detroit RotoGrate Stoker with six grate sections as applied to a typical water cooled furnace of a steam generator. Two of the six Rotors removed to show the overlapping grate design.

DETROIT STOKER COMPANY

GENERAL MOTORS BUILDING, DETROIT 2, MICHIGAN

WORKS AT MONROE, MICHIGAN • DISTRICT OFFICES IN PRINCIPAL CITIES

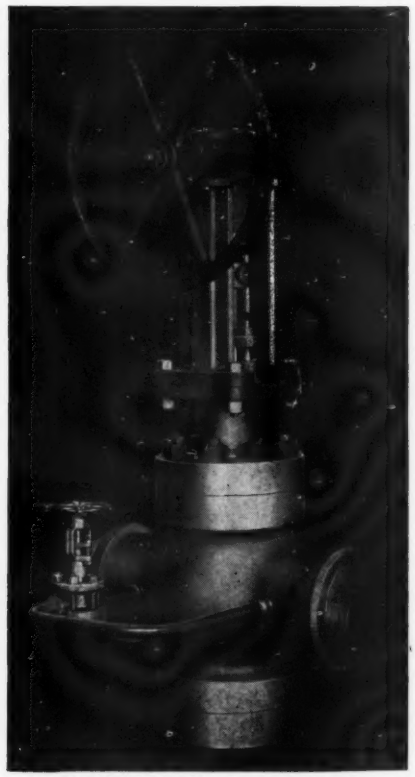


Republic 12 in. cylinder operated valve

REPUBLIC

GENERAL SPECIFICATIONS

- Built in all pressure standards—both flanged and welded ends.
- Streamlined flow through parts virtually eliminates erosion.
- Single seated valves—guaranteed drop tight.
- Double seated valves—guaranteed maximum leakage less than 1/2%.
- Steam valves have heat treated stainless steel trim with screwed in seats.
- Water valves have welded in seat rings with hard surface overlay—on small valves overlay is made directly on body.
- All valves are engineered to the job or application.



Republic 6 in. hand operated valve

REPUBLIC FLOW METERS CO.

VALVES REPUBLIC

Regulating — Pressure Reducing — Shutoff

CYLINDER OPERATED—double seated

Republic cylinder operated valves are of the gradual opening, high lift, double seated type. They are hydraulicly operated to assure smooth performance at any speed regardless of size, static pressure or pressure reduction. These valves are available in sizes from 3″ to 24″, with or without hand operating wheel. Due to compact design, a regulator may be mounted directly on the valve.

HAND OPERATED—large sizes

Republic hand operated valves, in sizes from 3″ to 8″, are built to 900 lb. and 1500 lb. pressure standards. They are of the single seated type, have a one piece valve stem, and seat rings that are Stellite surfaced and welded in place. The gear reduction head is built with ball or roller bearings and precision ground gears for minimum friction and back lash. These valves are recommended for flow control and shutoff applications.

HAND OPERATED—small sizes

Republic single seated hand operated valves are also available in 1″, 1½″ and 2″ sizes, built to 600 lb., 900 lb. and 1500 lb. pressure standards. These valves also have a one piece valve stem, and a Stellite surfaced seat integral with the valve body.

LEVER OPERATED—large sizes

Republic double seated lever operated valves are ideal for air actuation with long stroke cylinders. They are available in sizes from 3″ to 16″ for low pressure applications and in sizes up to 6″ for 1500 lb. applications. The lever mechanism, of sturdy construction capable of taking full strains of power cylinders, is adjustable with full cylinder stroke to change valve capacity.

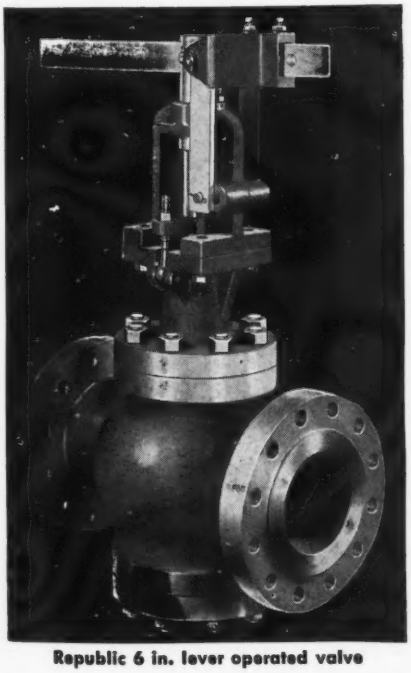
LEVER OPERATED—small sizes

Republic single seated lever operated valves are available in sizes up to 2″ and for pressures up to 1500 lb. standard. The valve seat is Stellite surfaced and integral with the valve body. The sturdy lever mechanism is adjustable for lift. Many of these valves are in operation on water lines with over 1000 lbs. pressure reduction.

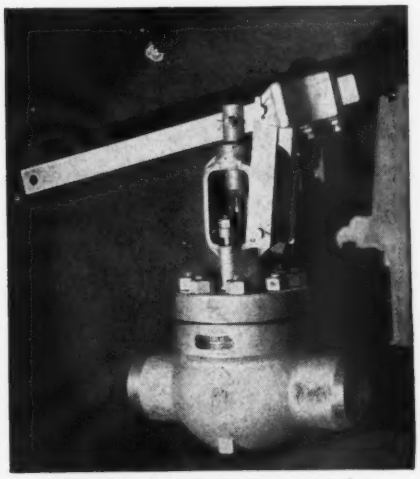
BUTTERFLY VALVES

Republic butterfly valves can be supplied in cast iron or steel for pressures up to 300 lbs. Vanes can be supplied of the angle seating or swing through types. The shaft can be mounted on ball or plain bearings as required. A valve operator may be mounted directly on valves of 6″ size and over.

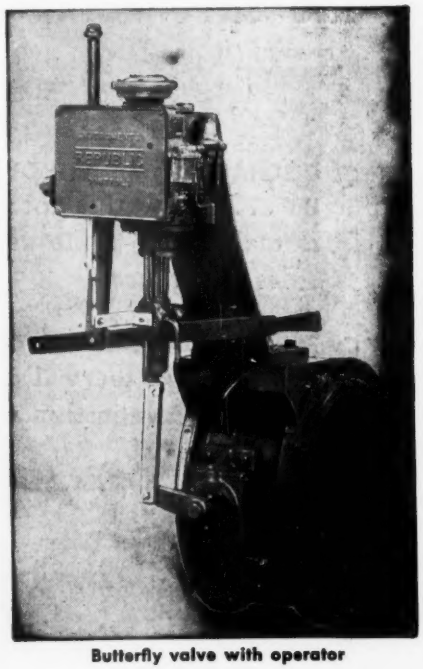
All Republic valves are engineered to the specific job on which they are to be used. Our engineers will be glad to consult with you on any of your valve problems. Write, asking to have one of our engineers call.



Republic 6 in. lever operated valve



Republic 2 in. lever operated valve



Butterfly valve with operator

2240 Diversey Pkwy., Chicago 47, Illinois

Investigate the NEW

CENTRAFIRE

with the famous Link-Grate

The spreader-type stoker that gives you these PROVED points of superiority!

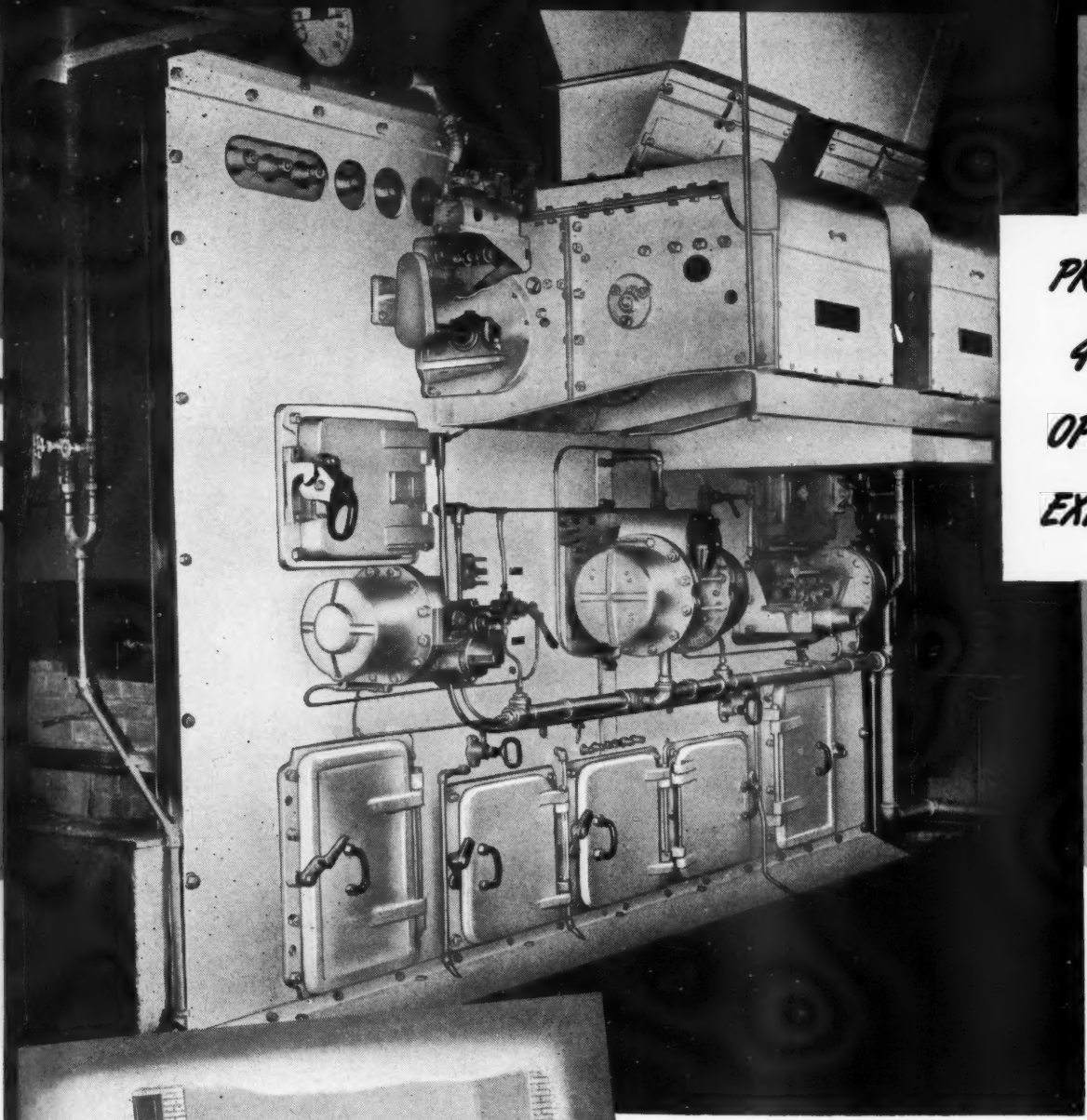
- **DISCHARGES ASH WITHOUT REDUCING CAPACITY** . . . coal feed is not interrupted and fire is maintained while ash is discharged at sides of furnace.
- **PRECISELY ARRANGES FUEL, AIR AND GASES** . . . for high thermal efficiency and maximum fuel combustion.
- **FEEDS COAL EVENLY** . . . carefully designed feeder rams provide a positive feed of coal —*wet or dry.*
- **FIRES ANY GRADE COAL** . . . the lowest grades of bituminous . . . even lignite . . . are burned economically.
- **DISTRIBUTES COAL UNIFORMLY** . . . continuous trajectory control provides uniform distribution . . . regardless of size consist.

J-50485-A

and what's more...

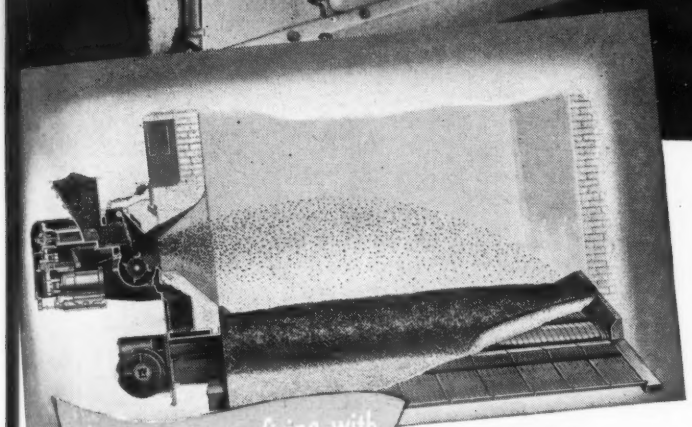
Centrafire will carry light loads or full loads for extended periods . . . or will respond to increased demand from light load to full load without sacrificing efficiency.

Call your nearest Westinghouse office or write Westinghouse Electric Corp., P.O. Box 868, Pittsburgh 30, Pennsylvania



PROVED BY 4 YEARS OPERATING EXPERIENCE

Four years of operating experience has resulted in the design and construction refinements exemplified in this year-old installation of American Home Foods, Inc.

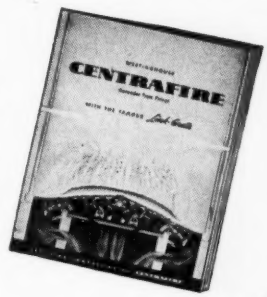


here's precision firing with maximum fuel combustion

See CENTRAFIRE'S Outstanding Superiority . . .

Send for This New Booklet

This informative booklet shows, in full color, exactly how Centrafire, with the famous Link-Grate, achieves high thermal efficiency and maximum fuel combustion. Write for your free copy. Ask for B-3890.



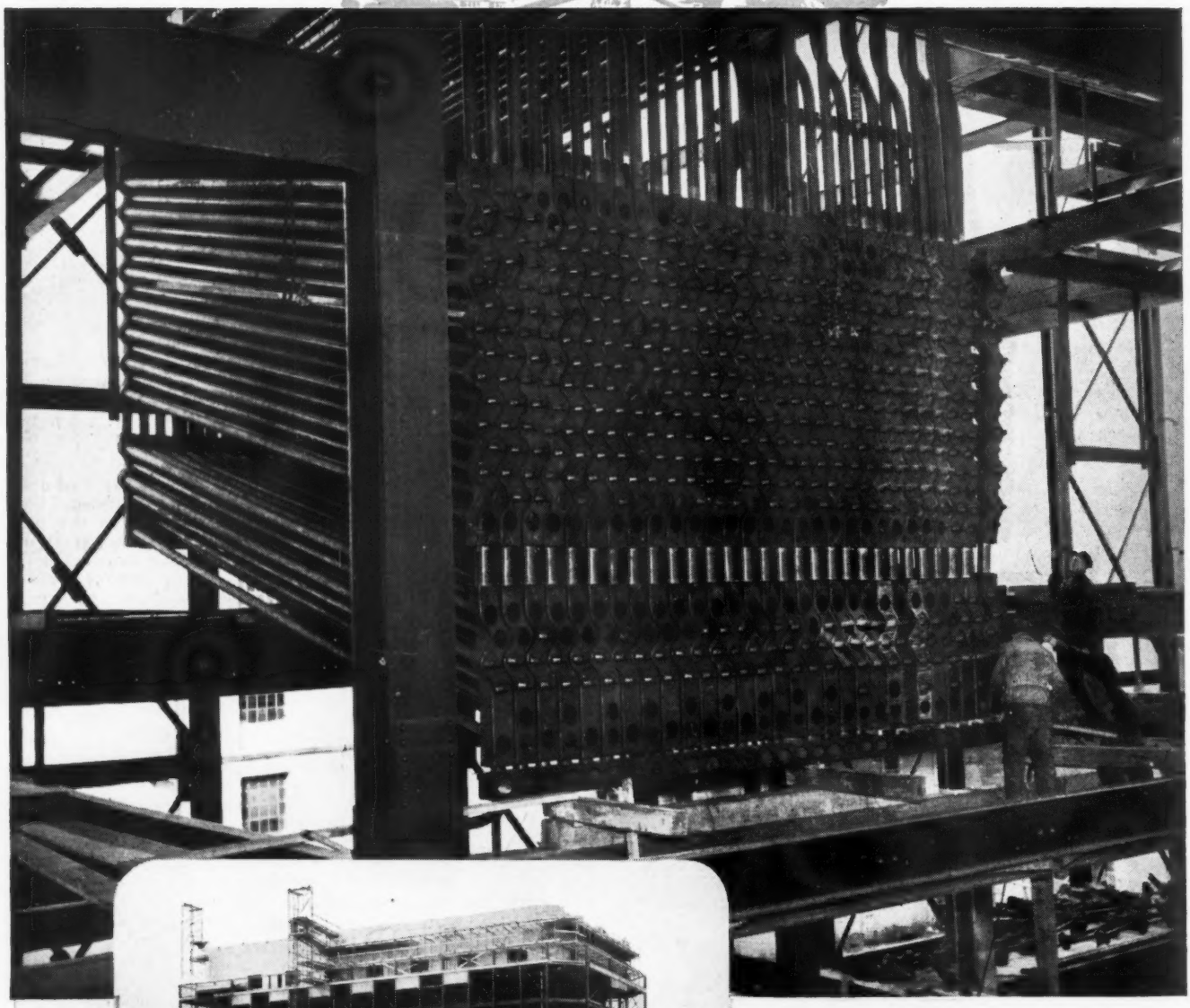
Westinghouse

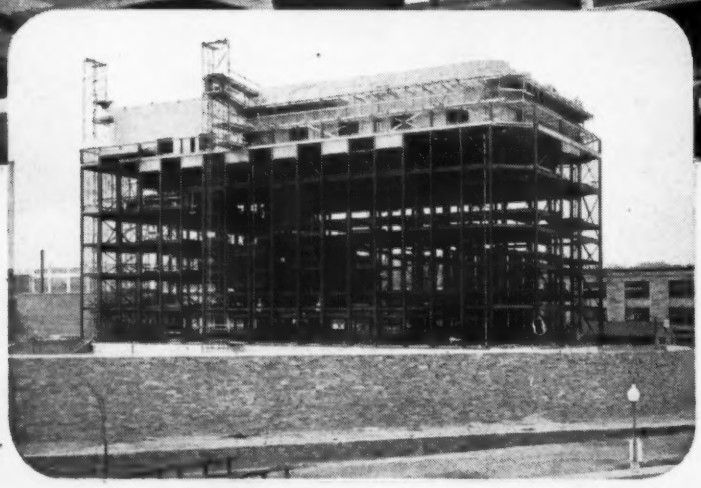
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

CENTRAFIRE

with the famous Link-Grate

In WASHINGTON it's





Above: Photo of one of the two Vogt boilers during installation. West Central Heating Plant, construction view of which is shown at left, was designed by the office of the Supervising Architect, Public Buildings Administration, Federal Works Agency. Constructing Engineers, Charles H. Thompkins Co., Washington, D.C.

ELECTRUNITE

FOR BOILER INSTALLATION AT NEW WEST CENTRAL HEATING PLANT

Another in the ever-growing list of installations in which Republic ELECTRUNITE Boiler Tubes have been included in original equipment is the newly completed West Central Heating Plant in Washington, D.C.

Each of the two Vogt boilers in this installation has a continuous capacity of 150,000 pounds of steam per hour. Designed to relieve the excessive load on existing steam generating facilities, these units will furnish heat for numerous government office buildings in the Washington area.

In this, as in countless other original equipment installations, the choice of ELECTRUNITE indicates the unfailing dependability provided by these modern electric resistance welded boiler tubes. Actual installation records prove, too, that ELECTRUNITE Boiler Tubes are unsurpassed for easy expanding and rolling-in to tight, non-leaking joints.

For complete information about ELECTRUNITE Boiler Tubes and Republic's improved process by which they are made, write *today.*

Uniformly high ductility—freedom from "hard spots"—assure tight, non-leaking joints with Republic ELECTRUNITE Boiler Tubes.

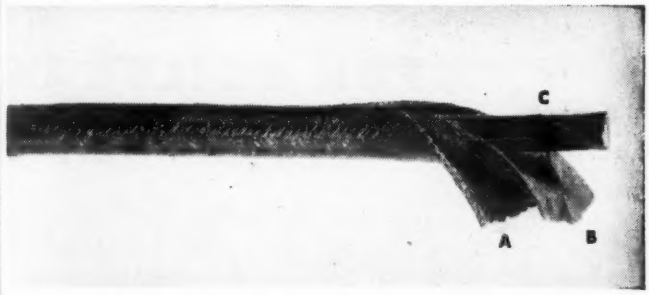
REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Export Department: Chrysler Building, New York 17, N. Y.

Republic
REPUBLIC STEEL
REG U S PAT OFF
ELECTRUNITE
REG U S PAT OFF
BOILER, CONDENSER AND HEAT EXCHANGER TUBES

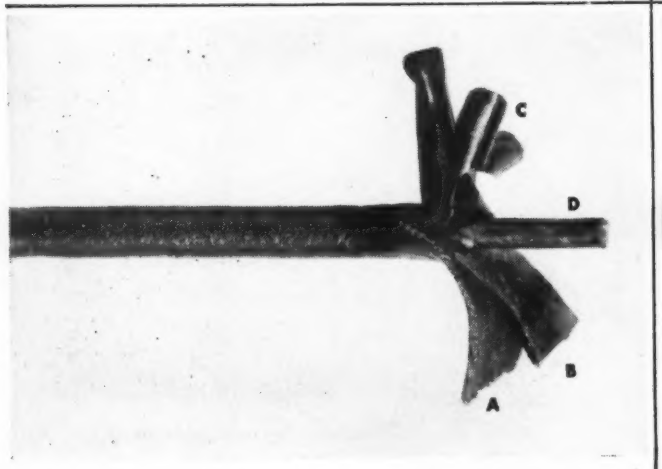
These Construction Features Give You the Cable

THAT'S PERMANENT

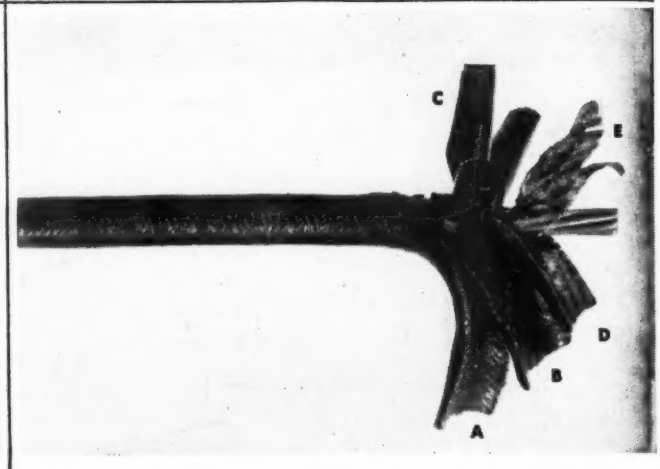
1. Take a sample of Rockbestos A.V.C. Power Cable, illustrated, or similarly insulated Motor Lead Cable, slit open the heavy asbestos braid (a) which is resistant to heat, flame, moisture, oil, and grease, and you'll find beneath a firewall of felted asbestos (b) a permanent heat-barrier against high ambient temperatures.



2. Then cut through this felted asbestos wall (b) peel it back, and see the high-dielectric, moisture resistant varnished cambric tape (c) it protects from heat, flame and oxidation. Notice, too, the uniform coverage of the tapes, helically applied like the felted asbestos to assure perfect and permanent centering of the conductor in the insulation.



3. Now unwind the tapes (c) and underneath you'll see a second wall of impregnated felted asbestos (d) the inner heat-barrier that serves as a baffle against conductor-heating overloads to complete the protection of the varnished cambric.



4. Finally, slit and peel back this felted asbestos wall (d) and beneath is the paper separator (e) which keeps the conductor clean of insulation and makes stripping easy —and that concludes the story of the wire with permanent insulation.

...it all adds up to "the Original Rockbestos A.V.C."

WRITE TODAY — for your copy of the new No. 10-F Catalog, sectioned for easy reference to permanently insulated Lighting Wires, Power and Control Cables; Apparatus Wires and Cables; Switchboard, Appliance, Fixture, Electronic and Magnet Wires.

ROCKBESTOS PRODUCTS CORP.
641 NICOLL STREET, NEW HAVEN 4, CONNECTICUT
NEW YORK CLEVELAND DETROIT CHICAGO
PITTSBURGH ST. LOUIS LOS ANGELES OAKLAND, CALIF.

ROCKBESTOS

THE WIRE WITH PERMANENT INSULATION

If you're interested in valves that will give you any or all of these operating advantages then, you'll be interested in

NON-CONTAMINATING

MINIMUM MAINTENANCE

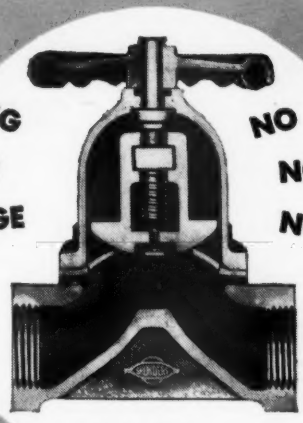
NO VALVE STEM LEAKAGE

NO CORROSION

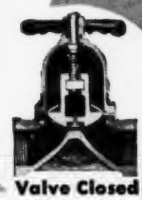
NO CLOGGING

NO SEEPAGE

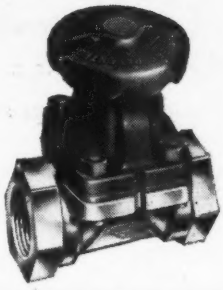
GRINNELL-SAUNDERS DIAPHRAGM VALVES



Valve Open

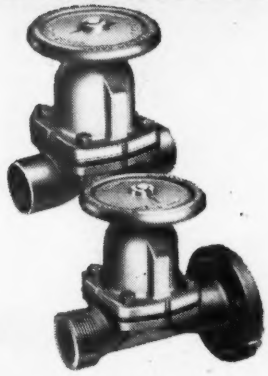


Valve Closed



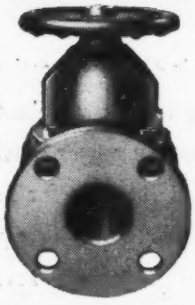
FOR CHEMICALS

Stainless Steel valves with special diaphragms are handling satisfactorily such corrosive chemicals as phosphoric, acetic and chromic acids.



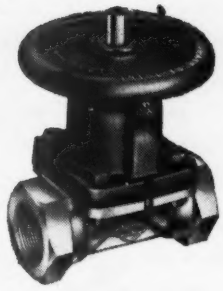
FOR BEVERAGES

Bronze valves with socket ends (left) and with hose threaded end (right), both with special white rubber diaphragms, are stopping leaks and cutting maintenance to the bone in breweries handling millions of barrels of beer.



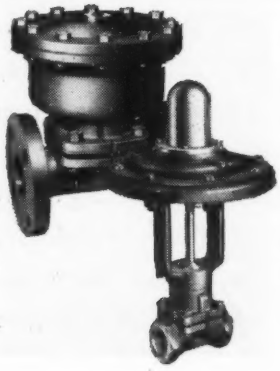
FOR PULP and PAPER

Rubber lined valves are setting new performance records handling pulp, alum and sulphuric acids in paper mills.



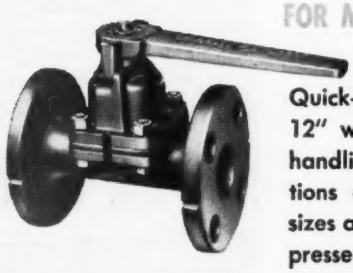
FOR TEXTILE PLANTS

Aluminum body valves with rising stems have won enthusiastic approval in bleacheries handling hydrogen peroxide and other chemicals.



FOR FOODS

Piston-operated valves (left) and air motor operated valves (right), both glass lined and with proper diaphragms, are providing remote control in plants handling sodium chloride, sodium hydroxide, sulphuric acid and fruit juices.



FOR MINES

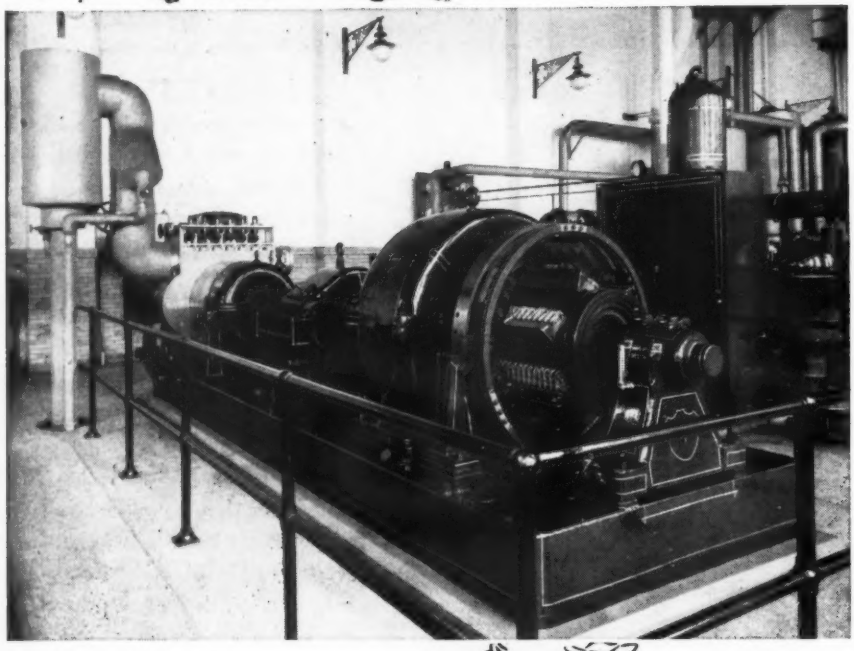
Quick-operating valves up to 12" with rubber lining are handling highly abrasive solutions and slurries. Smaller sizes are widely used on compressed air lines to prevent leakage.

Grinnell-Saunders Diaphragm Valves may eliminate valve troubles and cut valve maintenance on your pipe lines. Available in any combination of valve bodies and linings, diaphragms and operating mechanisms. State your requirements or ask for Catalog 6-E on "Grinnell-Saunders Diaphragm Valves". Grinnell Company, Inc., Providence 1, R. I. Branch warehouses in principal cities.

GRINNELL

WHENEVER PIPING IS INVOLVED

This veteran has been PAYING a bonus for years!



The Worthington installation at the Oak Forest, Illinois, Infirmary. The 600kw geared direct-current turbine-generator is non-condensing, operating on steam at 150 lb initial pressure, 0 deg F superheat, and exhausting to 3 lb back pressure.

A Worthington Turbine-Generating Unit That Soon Earned Its Purchase Cost

Take a look at a gilt-edged investment in power! The Worthington Turbine-generating unit shown here was installed in the Oak Forest Infirmary, Cook County, Illinois, almost ten years ago. Besides generating electric power, the turbine supplies exhaust steam for heating water, cooking, baking and to heat various buildings. No live steam direct from the boilers is used for heating because, like the turbine-generating unit, most of the auxiliaries such as pumps and fans are steam driven.

Since installation this Worthington unit has operated continuously without attention — except for routine inspection.

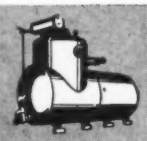
The Infirmary's engineers estimate that by running their own plant — instead of purchasing power outside, and generating steam only for heating — the resultant savings have paid for the Worthington unit several times over.

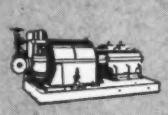
When YOU Buy Turbine Power ... make sure you're getting the lasting economy and efficiency that proves *there's more worth in Worthington.* For further information, including expert technical advice on power problems, write to *Worthington Pump and Machinery Corporation, Steam Turbine Division, Wellsville, N. Y.*

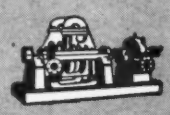
T8-1

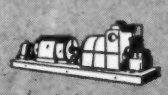
WORTHINGTON

A GREAT TEAM IN STEAM

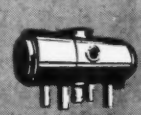

Feed Water Heaters


Multi-Stage Turbines


Boiler Feed Pumps


Turbine-Generator Sets

Single-Stage Turbines


Surface Condensers

How to make your dollars go further in stainless piping

Practical engineers show you the dollar-saving way to increase your alloy piping efficiency in "Corrosion Resistant Piping," a comprehensive discussion prepared by the Taylor Forge engineering staff and on the presses now.

This new, fact-filled bulletin discusses the fundamentals involved in minimizing the cost of stainless materials . . . points out the advantages of conforming to IPS outside diameters . . . discusses Schedules 5S, 10S, 40S, and 80S in relation to pressures and temperatures . . . gives you a new slant on flanged connections . . . offers a realistic approach that will prove helpful to you. The supply is limited, so write today to reserve your copy.

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Whatever your piping problem, "Corrosion Resistant Piping" will help you do a better job. Write at once.

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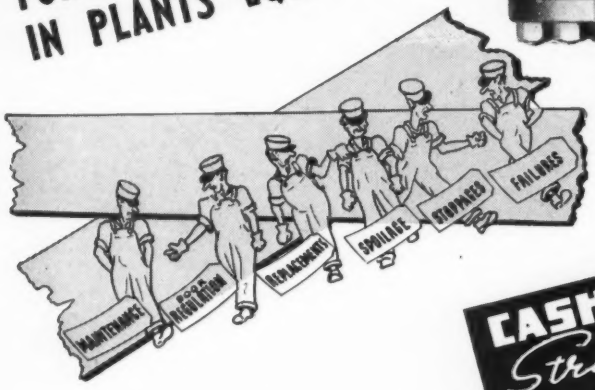
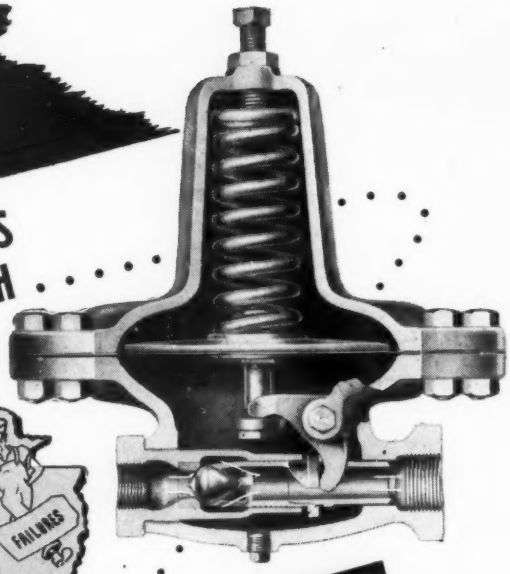
FOR THESE TROUBLEMAKERS IN PLANTS EQUIPPED WITH . . . . .





CASH STANDARD *Streamlined* PRESSURE **REDUCING VALVE** TYPE 1000

Here's why

IN THE USERS OWN WORDS . . . . .

(Note how users' statements check against the 10 benefit points listed below)

FROM A TIRE COMPANY

"We installed your '1000' reducing valve in our re-capping set-up about six years ago and to this date we have had **trouble-free** service. Periodically I check steam **pressure** and find it to be very **accurate.** I wouldn't hesitate a minute in recommending your Streamlined Reducing Valve."

FROM A BUTTON MANUFACTURER

We use the type '1000' valves on one of the **toughest operations** and they have operated 24 hours per day for the past 2½ years with **no maintenance."**

FROM A GLASS MANUFACTURER

"We have one set of five pressure reducing valves (CASH STANDARD '1000') on a Hartford Empire ZU forehearth that have **operated accurately** and **trouble free** for five years **without** a dimes worth of **maintenance."**

FROM A LAUNDRY

"We are well satisfied. We get **accurate pressure control under toughest working conditions — trouble-free service — cost-saving operation and practically zero in maintenance costs."**

FROM A CHEMICAL MANUFACTURER

"We purchased our first CASH STANDARD Type '1000' Streamlined Valve six years ago and since then we have installed more than 200 of the '1000' valves ranging in size from ¼" to 1½". This is indicative of our complete satisfaction with the operation of the '1000'. A large number of the pressure reducing valves are **operating above your maximum specifications of temperature and pressure** with excellent results.

"The **elimination** of **steam leaks** and the **low maintenance** cost have been especially gratifying. The low initial cost, **low maintenance,** and **trouble-free** operation results in the **most economical** pressure reducing valve we have been able to purchase."

1. **Maximum capacity when needed most.**
2. **Accurate pressure control under toughest working conditions.**
3. **Trouble-free service.**
4. **Smooth operation.**
5. **Tight closure.**
6. **Speedier production results.**
7. **Elimination of failures.**
8. **Cost-saving operation.**
9. **No spoilage.**
10. **Practically zero in maintenance.**

• WRITE FOR BULLETIN 962

CASH STANDARD CONTROLS . . . VALVES

A. W. CASH COMPANY

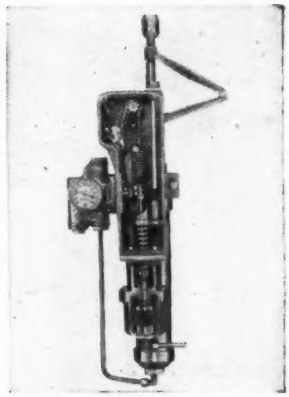
DECATUR, ILLINOIS

•

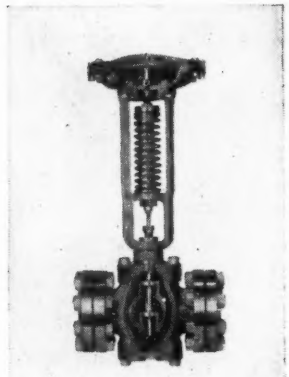
BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES

Send for them

•



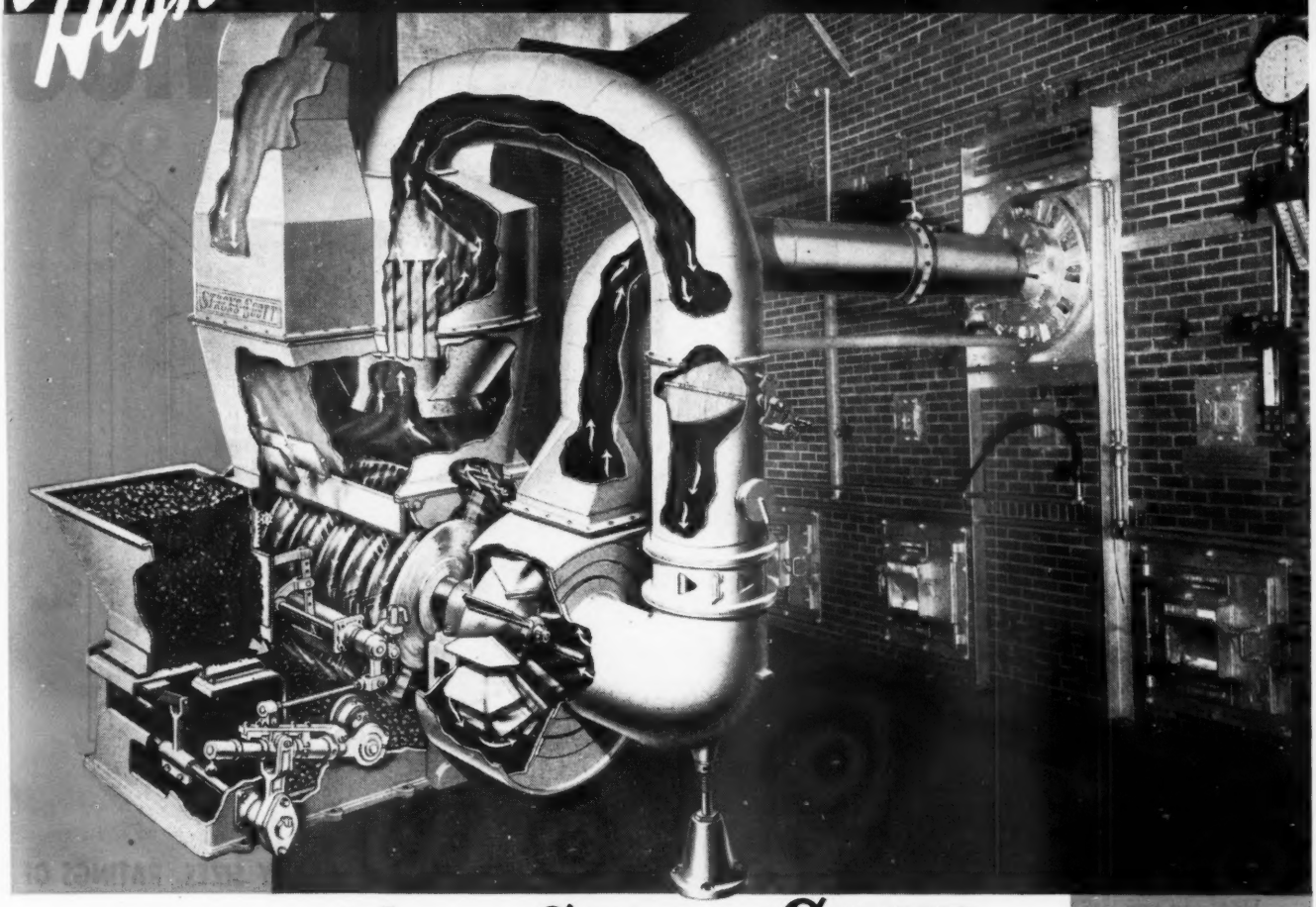
Bulletin 963 features the CASH STANDARD Type 100 Series of Super-Sensitive Controllers — various types for automatically operating valves, dampers, rheostats, stokers, pulverizers, fans, and other apparatus. 16 pages filled with descriptions and applications.



Bulletin 968 features the CASH STANDARD Type 34 Pressure Reducing Valve — direct operated — direct acting for handling steam, hot water, cold water, air, oil, brine—and most liquids and gases except some injurious chemicals. Illustrates and describes the different styles available and tells about their applications. Three pages of capacity charts.

Bulletin 956 features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.

Higher COMBUSTION EFFICIENCY



. . . with a STRONG-SCOTT UNIT PULVERIZER

You are assured of the highest possible combustion efficiency at all times with a STRONG-SCOTT Unit Pulverizer. Automatic underfeeding of fuel, and flexible fuel-air-mixture controls adjust quickly to any situation.

Proof of STRONG-SCOTT efficiency is shown by the fact that repeat orders comprise over 40% of their pulverizer volume. These repeat orders come from satisfied customers who are expanding their steam-generation facilities. Hundreds of units are installed in over 200 North American cities, and foreign countries.

Take a look at any STRONG-SCOTT installation. See its rugged and simple design, its flexibility, its adaptability to varying local conditions. Every STRONG-SCOTT installation is backed by 51 years of manufacturing experience—24 in the combustion engineering field.

4 Outstanding Advantages

1. **Fires constantly and uniformly.**
   Meets fluctuating load demands easily and quickly, by automatic underfeeding of fuel, and by flexible fuel-air mixture controls.
2. **Handles wet coal better.**
   4 to 5 times as much preheated air passes thru the grinding chamber as thru any other pulverizer. Dries thoroughly as it grinds.
3. **More steam per pound of coal with less smoke.**
   Air swept attrition pulverizes your coal and floats it in the air for an ideal combustion mixture.
4. **Eliminates banking losses.**
   Furnace responds almost as quickly with coal as with gas or oil. Quick, easy ignition gives hot fire immediately . . . maximum steam output in half an hour if need be.

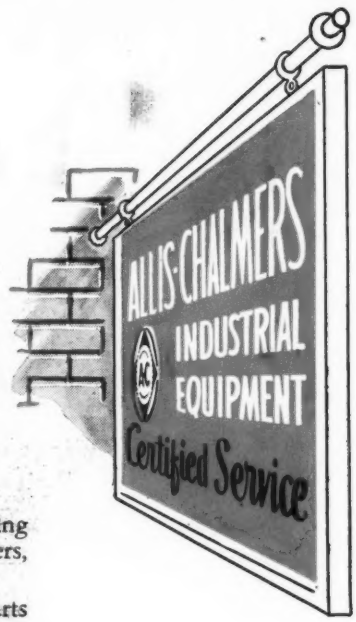
WRITE for Bulletin 341 for complete information. Users' names in your vicinity furnished on request.

The STRONG-SCOTT Mfg. Co.
455 TAFT STREET N. E. • MINNEAPOLIS 13, MINN., U. S. A.

STRONG-SCOTT UNIT PULVERIZER

"Certified" Service

AN ADDED REASON FOR INVESTING IN ALLIS-CHALMERS MOTORS!



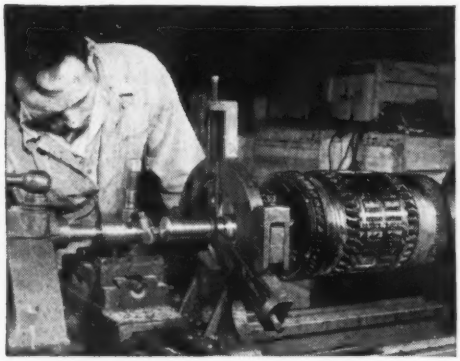
IT MEANS: 1) *Better, Faster Service.* Independent local repair shops are now being selected and authorized to service and repair Allis-Chalmers Motors, Transformers, Controls, Pumps — and "Certify" them as to workmanship.

2) *Finest Parts and Workmanship.* Shops use genuine Allis-Chalmers repair parts — or parts of equal quality; and are given complete service information, including factory procedure and drawings where necessary.

3) *Friendly Service.* Every Allis-Chalmers "Certified" Service Shop has been selected on the basis of its reputation in its community. It's the kind of company you *like* to do business with!

How can you get this service? For the present most "Certified" Service Shops are located in the larger U. S. industrial areas . . . but they're expanding rapidly. Call your nearby A-C District Office or Authorized Dealer for closest recommended shop. ALLIS-CHALMERS, MILWAUKEE 1, WIS.

FINER, FASTER, FRIENDLIER SERVICE FOR INDUSTRY!



The A-C Supply Company of Cuyahoga Falls, Authorized Allis-Chalmers Dealer and newly-appointed "Certified" Service Shop, is staffed and equipped to give prompt, efficient, top-quality repair and service aid to customers in the greater Akron industrial area. Typical of the kind of "Certified" Service organizations being selected throughout U.S.

MANY SIZES, RATINGS OF ALLIS-CHALMERS STANDARD SQUIRREL-CAGE MOTORS ARE NOW AVAILABLE FROM STOCK. CHECK YOUR AUTHORIZED A-C DEALER, OR DISTRICT OFFICE FOR DETAILS.

A 2506

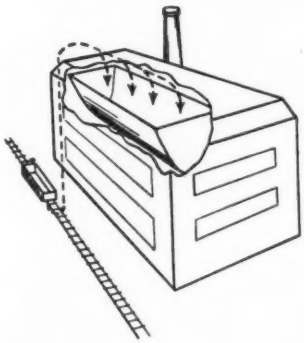
ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment—Biggest of All in Range of Industrial Products

JUST ASK US–

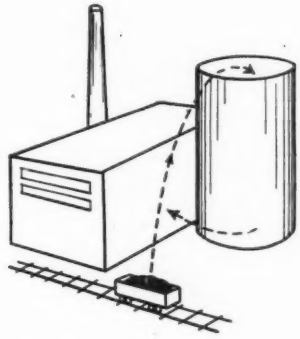
"How Would YOU Move It?"

No matter what *your* bulk material handling problems may be, the right engineering "know-how" will give you the answer! It assures the right equipment for a more efficient job—at lower cost per ton. S-A engineers, with 47 years' experience solving such situations, can help you. Are *your* problems like these?



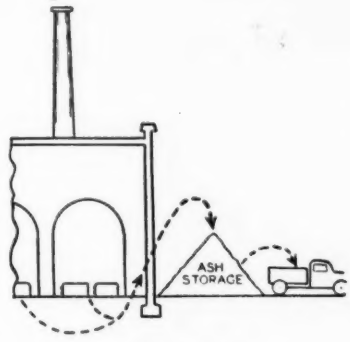
Put It Where You Need It

Here, coal has to move from car to bins at top of building. Even, dependable distribution to each bin is essential for proper firing of furnaces. S-A engineers are ready with the answer!



Dustless Delivery

In this plant, coal must be transported *without dust* from car to storage silo, then reclaimed as needed from bottom of silo for delivery to boiler room stokers. S-A can show you how to do it!



Efficient Ash Elimination

Ashes are to be taken from furnaces to storage and then removed by truck. System must prevent accumulation in boiler room and prevent scattering of dust. S-A engineers have the solution!

S-A engineers can frankly suggest the *best* system for every need, because the S-A line offers a *complete* assortment of belt conveyors, bucket elevators, Redlers, skip hoists and other equipment to choose from. Ask us to show how we can help you, *today!*

STEPHEN S-A ADAMSON MFG. CO.

5 RIDGEWAY AVENUE, AURORA, ILLINOIS · LOS ANGELES, CALIF. ★ BELLEVILLE, ONT.

Designers and Manufacturers of All Types of

BULK MATERIAL HANDLING EQUIPMENT

SMOOTH SAILING..

Fig. 150—150-pound Bronze Globe Valve with screwed ends, union bonnet and renewable composition disc.

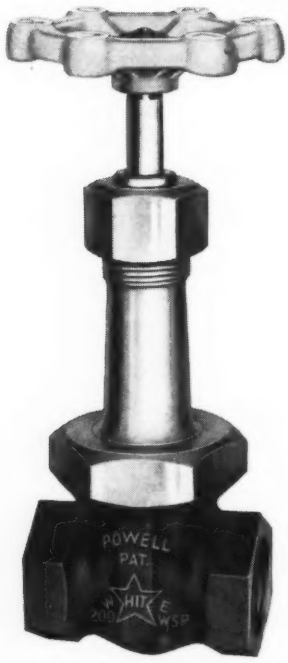


Fig. 375—200-pound Bronze Gate Valve with screwed ends, inside screw rising stem, union bonnet and renewable, wear-resisting "Powellium" nickel-bronze disc.

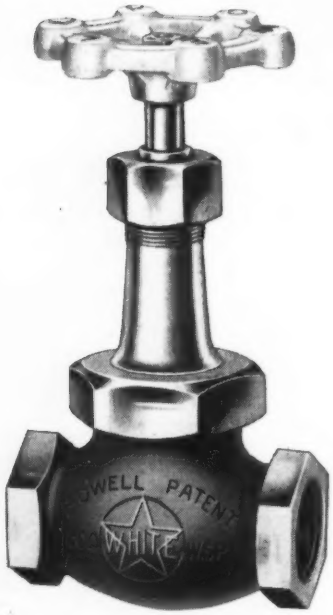


Fig. 1708—200-pound Bronze Globe Valve with screwed ends, union bonnet, renewable, specially heat treated stainless steel seat and regrindable, renewable wear-resisting "Powellium" nickel-bronze disc.

Powell Cast Steel Valves of all types are available in pressure classes from 150 to 2500 pounds, inclusive.

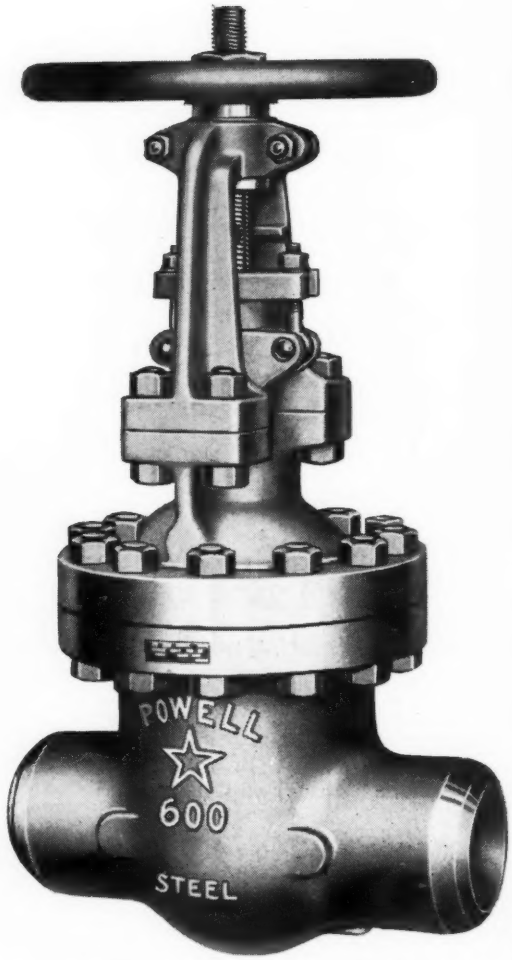
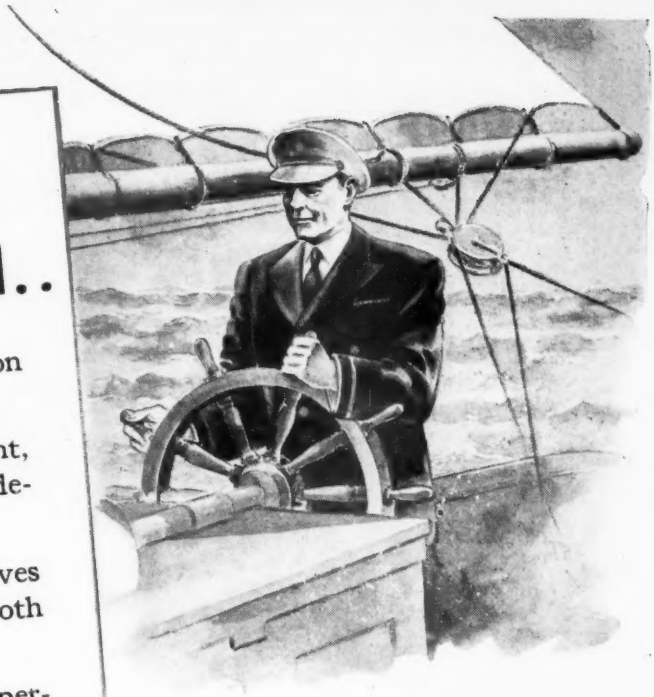


Fig. 6003 W. E.—Class 600-pound Cast Steel Gate Valve with welding ends, outside screw rising stem, bolted flanged yoke and tapered solid wedge.

POWELL

takes more than good weather and a fair wind..



For smooth sailing depends to a great extent on the efficiency of control exercised by the pilot.

Now in handling media in an industrial plant, the pilot is a valve and "smooth sailing" is dependent on the efficiency of its control.

And when it comes to flow control, Powell Valves are making an important contribution to "smooth sailing" in every branch of industry.

Powell Valves are noted for long, dependable performance at a minimum cost of maintenance. Moreover, there's a Powell Valve—in Bronze, Iron, or Steel—to meet the requirements of every known flow control service in the power field.

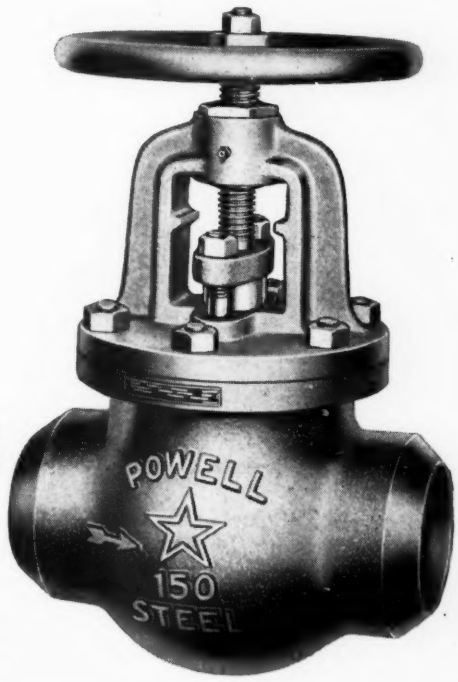


Fig. 1531 W. E.—Class 150-pound Cast Steel Globe Valve with welding ends, outside screw rising stem and bolted flanged yoke.

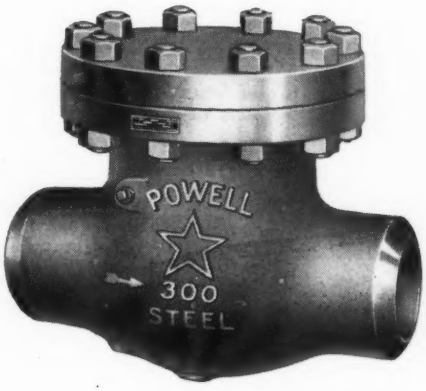


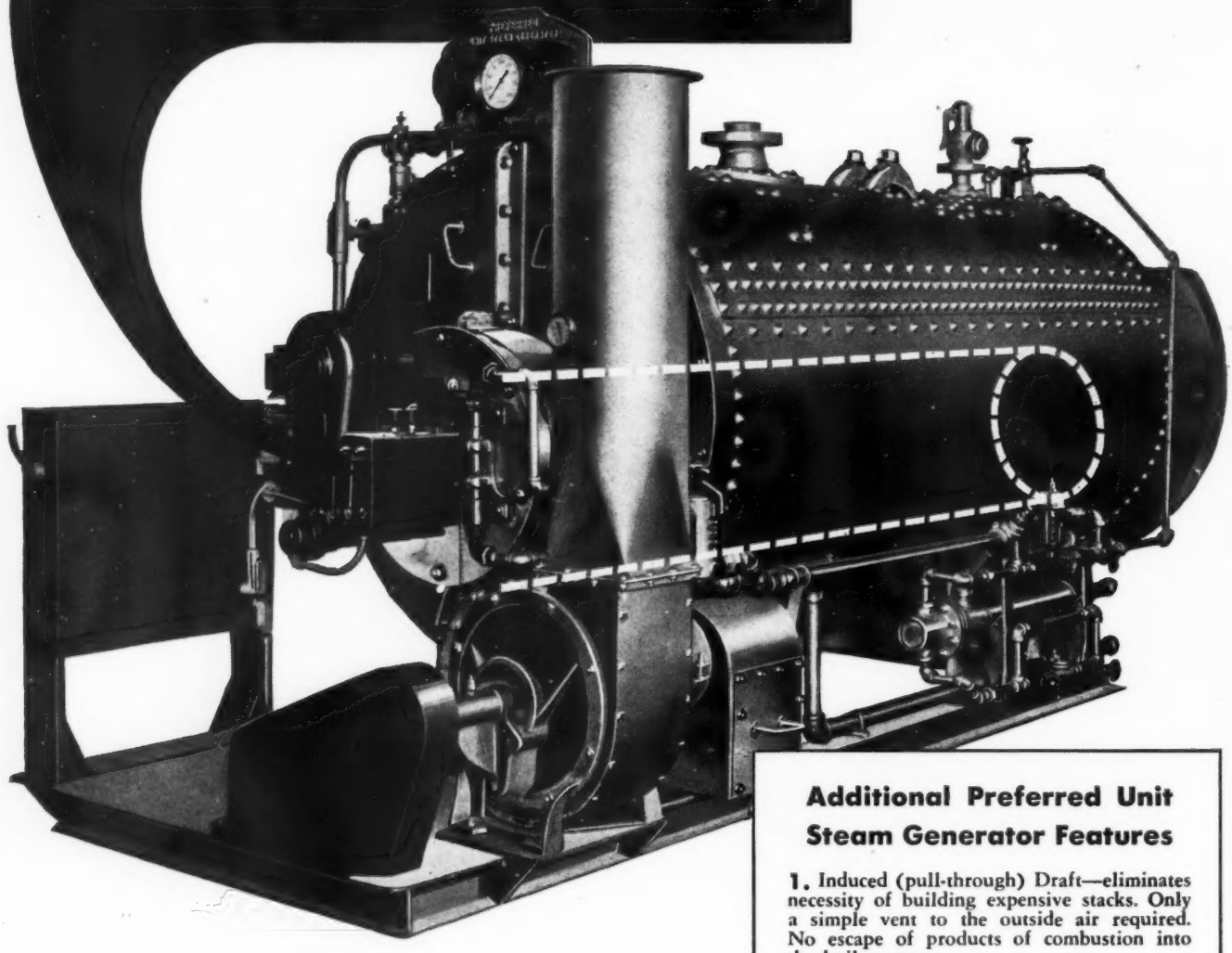
Fig. 3061 W. E.—Class 300-pound Cast Steel Swing Check Valve with welding ends and bolted cap. Disc has ample lift to permit full straightway, unobstructed flow through the valve body.

The Wm. Powell Company, Cincinnati 22, Ohio

DISTRIBUTORS AND STOCKS IN ALL PRINCIPAL CITIES

VALVES

Furnace Here Gives You EXTRA BENEFITS



Furnace relatively low in the drum saves you trouble because this location gives extra protection against damage due to low water—allows lower shell water level—and lessens liability of corrosion.

In addition to this "low-furnace" feature, the Preferred unit has both float and electrode type of low water cutoffs, thus affording triple protection against low water. As a result of this triple protection, no case has been reported of a Preferred furnace burning out. Because the furnace is below the point at which most of the steam bubbles form, it is in contact with water all the time . . . there's less possibility of corrosion from oxygen.

Shell water level is low, giving more steam releasing area. Additional steam dome capacity is gained. Foaming and water carry-over are minimized. Delivery of dry steam is assured.

These features are examples of the careful planning Preferred combustion engineers have put into the design of the Preferred Unit Steam Generator. They are examples also of the benefits you will get when you replace your present boiler with a modern Preferred Unit. Write today for complete information.

Additional Preferred Unit Steam Generator Features

1. Induced (pull-through) Draft—eliminates necessity of building expensive stacks. Only a simple vent to the outside air required. No escape of products of combustion into the boiler room.

2. Fully Automatic Operation—even with Bunker C or No. 6 oil.

3. Preferred Oil Burner—exclusive aid to perfect combustion, built especially for this unit.

4. Four-pass, Down-Draft Gas Travel—results in maximum heat absorption.

5. 80% Minimum Thermal Efficiency—proved and guaranteed.

6. Full Range of Sizes—from 20 to 500 h.p. and pressures of 15 to 200 lbs. Two-pass units in 20 and 30 h.p. with pressures of 15 lbs.

Four-pass units also available in all sizes for 250 p.s.i.g. design on special order. Write for complete details of these special units.

PREFERRED UTILITIES MANUFACTURING CORPORATION, 1860 Broadway, New York 23, N. Y.

P-8-48
PR-155

PREFERRED UTILITIES MFG. CORP.

...want more iron or steel?

TURN IN MORE SCRAP!

HERE'S WHAT YOU CAN DO TO HELP RELIEVE THE SCRAP SHORTAGE

1. Put some one individual in charge of scrap in all departments of your business and GIVE HIM AUTHORITY TO ACT.

2. Comb the plant and yards for dormant scrap, abandoned equipment, old boilers, pipe, moulds, obsolete dies and parts, material now wasting away which has salvage value.

Survey all plant equipment, particularly idle stand-by or discarded machines, with a view to scrapping all not convertible to useful production.

Consult your scrap dealer for advice on types, grades and sizes.

3. Segregate each class of scrap and supervise its handling to avoid contamination. This will increase its value. Identify, classify and provide separate containers, clearly marked, for each class of scrap material.

Dismantle discarded equipment promptly into its components—electrical, fastenings, lumber, etc.—so that these parts may be utilized or scrapped.

Sort sweepings and miscellaneous waste to recover scrap values.

4. Constant reminders in the form of posters, illustrations of right and wrong methods, pay envelope enclosures, house organ publicity, etc., are potent aids to the scrap recovery program.

EMBLEM OF INCO SERVICE
TRADE MARK

MORE SCRAP—MORE STEEL
Move your scrap to the mills—
Sell it...ship it...move it now!

THE INTERNATIONAL NICKEL COMPANY, INC.
67 WALL STREET
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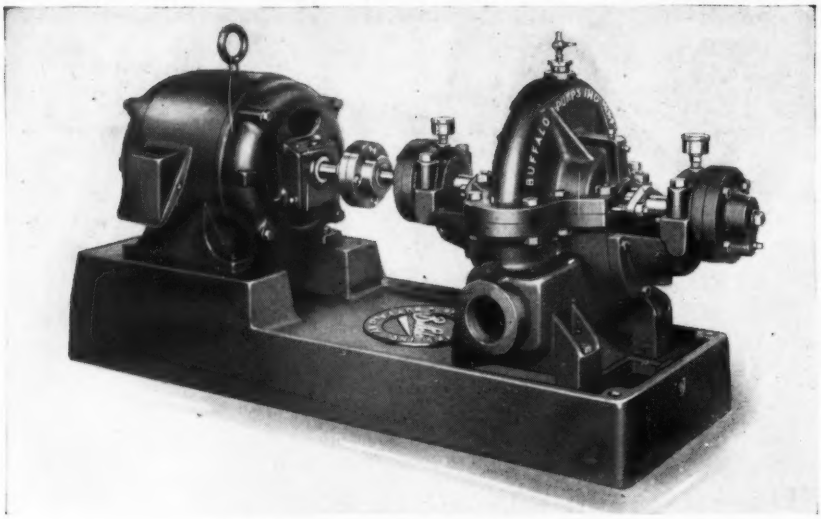

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Better Coal Preparation for Greater Combustion Efficiency

WITH

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= EVEN FIRE BED
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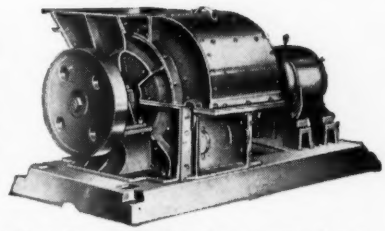

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Write for details on efficiency of coal preparation in power plants with American Crushers.

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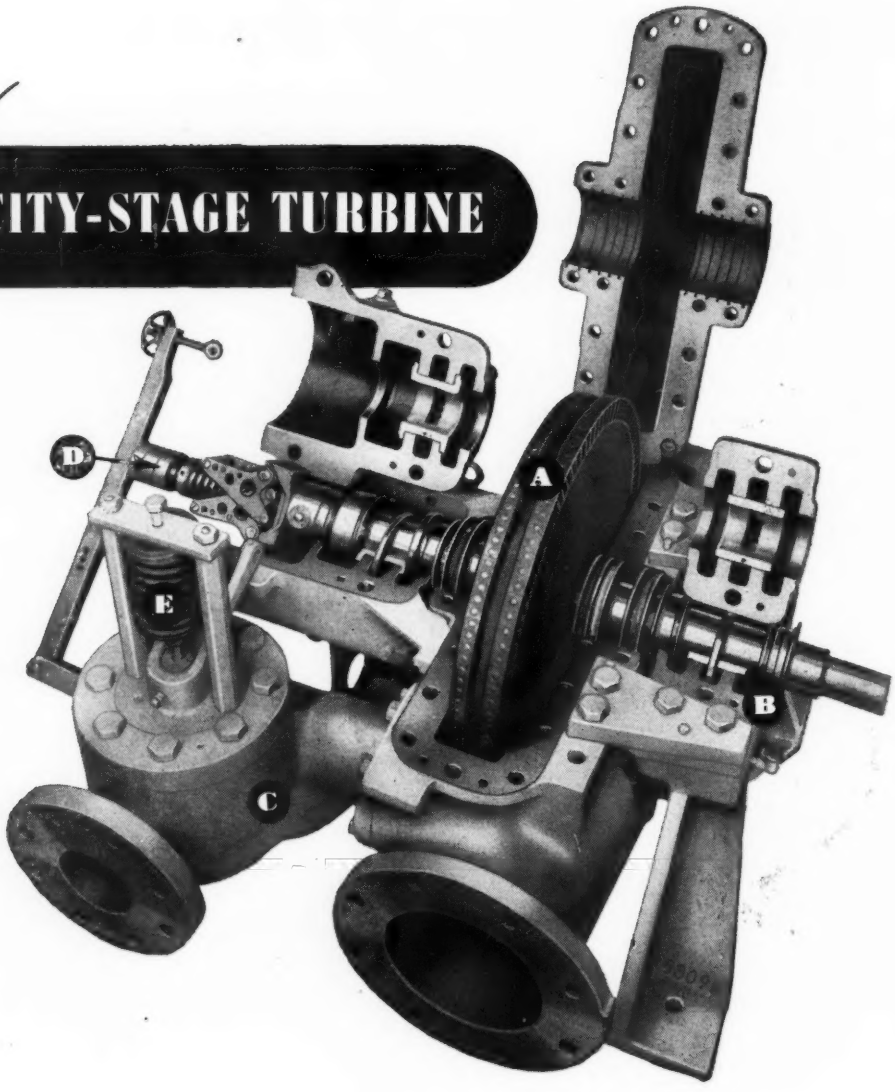

A *Improved bucket and nozzle ring design,* for high efficiency.

B *Center line support and flexible mountings,* to avoid misalignment from thermal expansion.

C *Steam chest in lower half of casing,* to permit removal of casing cover without disturbing piping.

D *Improved speed control.* Balanced regulating valve and direct acting governor permit close speed regulation. Speed can be varied readily while turbine is running.

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AUGUST 1948 VOLUME 92, NUMBER 8

A CROSS-INDEX OF SUBJECTS FOR THE MONTH

PLANT OPERATING METHODS, MAINTENANCE AND SAFETY
STEAM GENERATION, FUELS, FIRING AND COMBUSTION
TURBINES, ENGINES, AUXILIARIES; HYDRO POWER
DIESELS, GAS ENGINES AND ACCESSORIES
AIR CONDITIONING AND REFRIGERATION
ELECTRICAL EQUIPMENT, ELEVATORS
PIPING, VALVES AND SPECIALTIES
TRANSMISSION, LUBRICATION
STEAM SERVICES, HEATING
INSTRUMENTS, CONTROLS
PUMPS, COMPRESSORS

FEATURE ARTICLES

Good layout, economical design feature laundry boiler plant..... 64
Proper hand firing makes no smoke..... 68
Welding saves million dollars a year at Harbor Steam Plant..... 71
Extension brings Grand Haven diesel plant to 11,800 kva..... 74
Parallel operation of ac generators..... 77
How to choose the proper wire-rope construction..... 79
Rotary or steam-jet air pumps?..... 82
Save stress on boiler drums by planned operation..... 86
Automatic protection against electrical fires..... 89
Here's a quick way to find economical insulation thickness..... 90
Feedwater treatment removes troublesome coloring matter..... 92
Speaking of Power..... 94
Guymon station takes on load..... 95
High fuel costs revive reheating..... 99
Power services meet the fleet halfway..... 102
Rid water of dissolved gas to stop corrosion..... 105

DEPARTMENTS

Electronics, 5: Photoelectric tubes..... 107
Power engineers' notebook of plant-tested ideas..... 109
Solving problems from the power plant..... 112
Technical briefs: digests of recent developments..... 116
What's new in plant equipment..... 120
Data sheet: Arc of contact factors..... 130
News of the power field..... 132
The engineer's bookshelf..... 134

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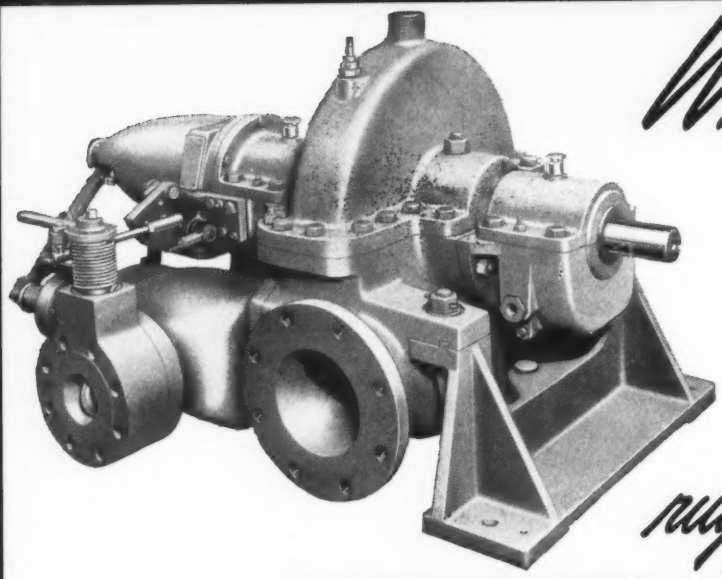

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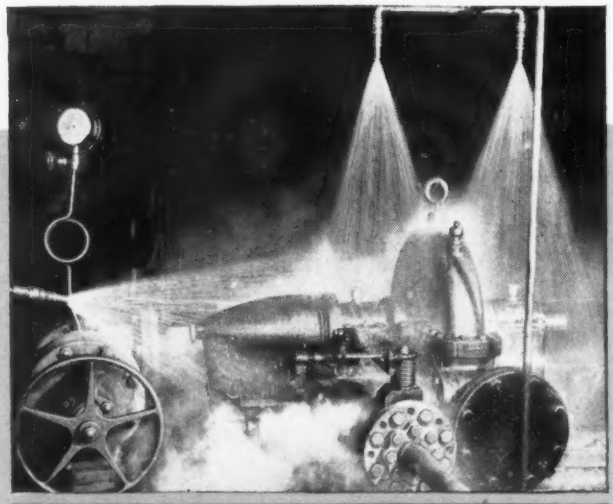

Water-test periods running for hours and hours—with turbine *operating* and *standing still*—prove the effectiveness of TYPEE bearing seals against water contamination of the lubricating oil.

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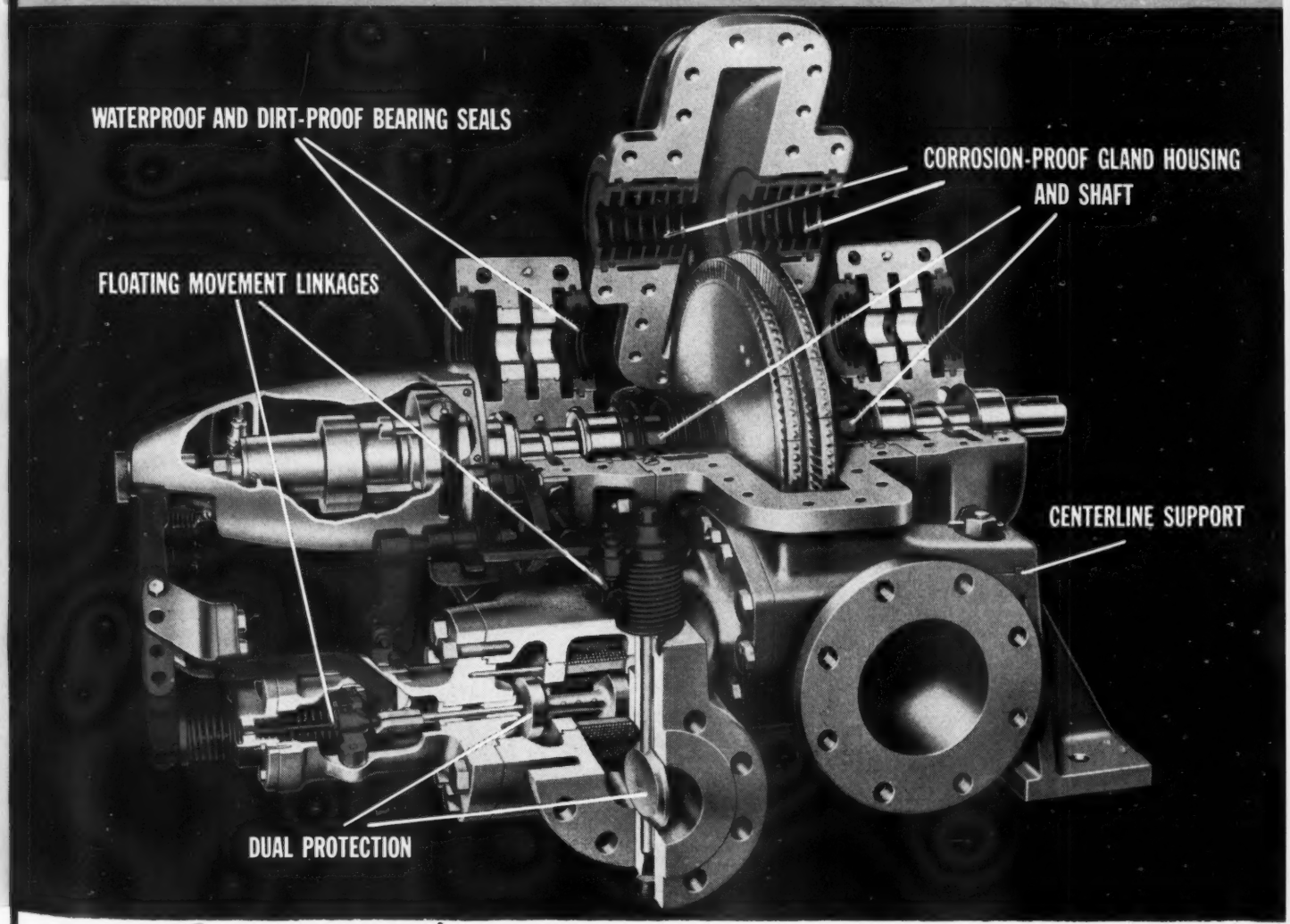
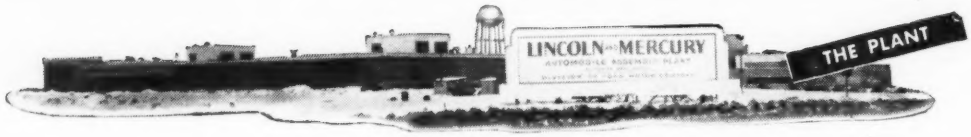


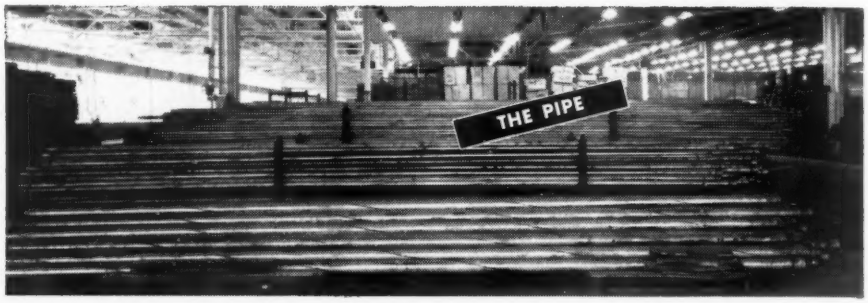
Steam Headquarters

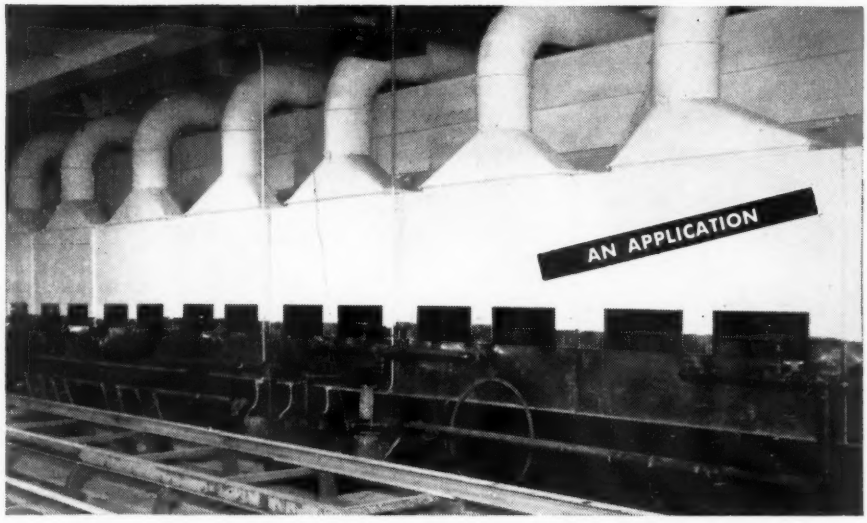
WESTINGHOUSE



Ford Motor Company uses *BYERS WROUGHT IRON PIPE*

to cut maintenance costs





The new Lincoln-Mercury assembly plant at Metuchen, N.J., naturally reflects the latest ideas and developments in every detail of design and construction . . . including major emphasis on the elimination of excessive maintenance. Ford Motor Company engineers specified wrought iron to forestall corrosive attack in certain services. One—illustrated—is recirculating water lines for washing air in the paint spray booths. Another—for which part of the pipe stock is shown—is a water cooling system for transformers to press machinery. The fabricator on this job was Consolidated Installations, Inc.

WATER HAZARD

With all the variety of fluids that piping is called on to handle today, water is still Public Enemy No. One in causing excessive repairs, and excessive replacements. Supplies vary widely in analyses. Only individual study and expert interpretation can predict the probable effect on piping. And only long familiarity with the performance of pipe materials under these varied conditions can provide a safe, sound basis for foretelling performance. A. M. Byers Company has the facilities and the accumulated experience to give right answers to these perplexing questions. And wrought iron has the inherent corrosion-resistance needed to successfully combat attack, in a large majority of situations.

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A knowledge of the character, manufacture, and properties of wrought iron is an excellent first-step in applying it correctly. Our booklet, "The ABC's of Wrought Iron" covers this entire subject. We will be glad to send you a copy. If you have any specific questions in connection with projected jobs, ask a representative, or the nearest District Office, for information.

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POWER

PHILIP W SWAIN, EDITOR • AUGUST 1948 • ESTABLISHED IN 1882

The New Engineering Education

FOR sound thinking on a vital problem we recommend *Trends in Engineering Education—The Columbia Experience*, a new book (Columbia University Press) by James Kip Finch, Columbia's Dean of Engineering. Here are points worth noting:

For many years the engineering schools have successfully taught (1) basic math, physics and chemistry, (2) such fundamental engineering sciences as thermo and hydraulics, and (3) practical applications, as far as time allowed.

All this was fine, yet something vital was still lacking. Today engineering leaders in industry, as well as in education, agree that the student needs also the broadening influence of certain "humanistic" studies—notably English, economics and history.

But finding the needed time for these courses is not easy. The engineering curriculum has always been full. For a while the 5-year course looked like the way out; it proved to be impracticable for various reasons. And there is no safe way to trim the fundamentals; no reputable school dares give less than a thorough grounding in basic math, science and engineering science.

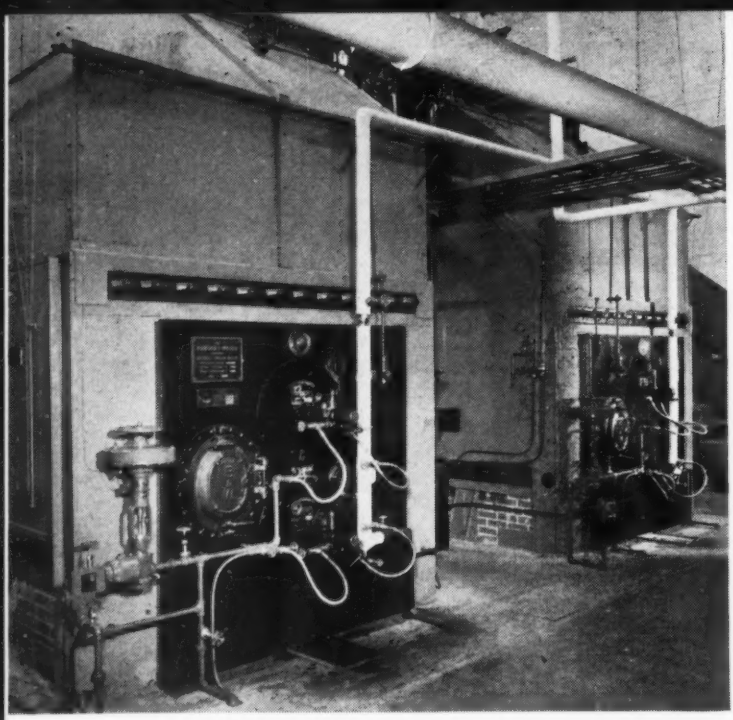
So it all comes down to this: To meet these primary responsibilities engineering schools will be forced to discard many popular and long-established "practical" courses. There is no other solution.

Industry should view this trend, as outlined by Dean Finch, with sympathetic understanding. After all, practical applications were never too well taught in school and can certainly be better learned on the job. And too often the man who was taught in engineering school how to design a boiler, actually got a job running a machine shop.

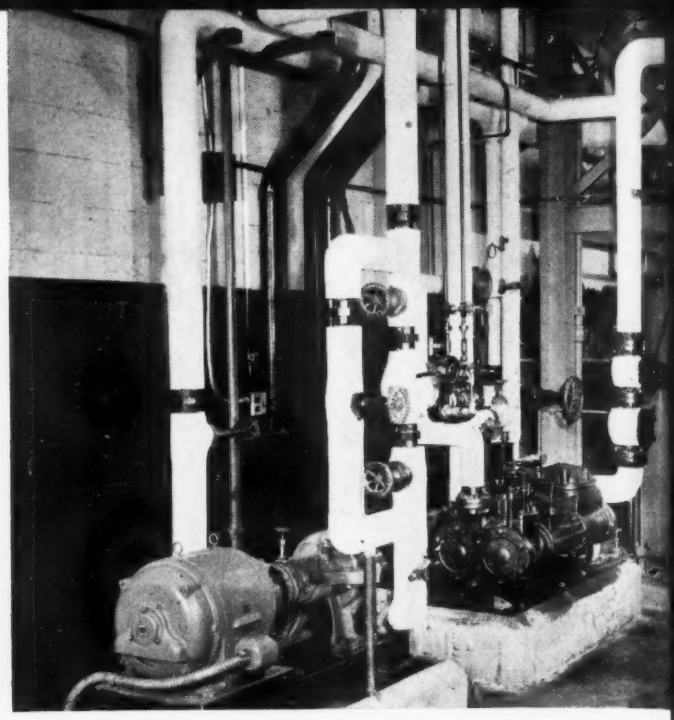
Finally industry will always need engineers who can think fundamentally. Fundamentals and culture missed in school are generally lost forever. If the price of this kind of education is some lack of practical facility at graduation it is not too much to pay for the long-run benefits obtained.

But a word of warning is in order. A sharp distinction must be made between the *unpracticed* fundamental *thinker* and the impractical theorist. The latter has little place in the hard-headed operations of everyday engineering. So it is fair for industry to remind the schools that their students are learning the fundamentals *as a sound foundation for later useful work on the job.*

The good teacher will never allow this objective to be forgotten. He will imbue his student engineers with the practical viewpoint, and will make sure they graduate with some idea of how to go about solving actual problems with real men, machines and money in a real world.



OIL-FIRED BOILERS of the integral-furnace type were selected to provide 100% standby and capacity for load growth



BOILER-FEED PUMPS in foreground, with zeolite softener and phosphate-feed pump in rear and feedwater storage tank, above

Careful Planning Pays Big Dividends

Putting "big-plant thinking" into the design of the smaller installation results in simplified, low-cost arrangement and efficient operation at the American Linen Supply Co, Seattle

By R F COMBS, *Chief Engineer, American Linen Supply Co*

► WITH THE FIRM CONVICTION that an efficient well-coordinated boiler plant need not be complicated or full of "frills," we began preliminary studies in 1945 for new steam-generating equipment at American Linen Supply Co, Seattle, Wash. The plant, which went into operation recently, proves our point, we believe, and shows again that smaller plants need not lag behind the parade.

American Linen Supply furnishes freshly laundered uniforms, linens and towels to hotels, restaurants, stores and similar businesses on a rental basis. In addition to the extensive laundry, there are facilities for manufacturing uniforms. Under direction and ownership of C W and R L Maryatt, this business has grown from the small laundry of 27 years ago, employing 12 people, to today's plant with 230.

Preliminary Study. Since laundry-plant production depends on an adequate supply of steam, the boiler room together with its equipment has always been a matter of great concern. Thus when growth of the business necessitated an increase in steam-generating capacity for the third time, we could not afford half measures. Experience has taught us that it always pays to make detailed studies; with present costs of labor and materials, we are convinced that such studies are more profitable than ever.

Among the many questions to be answered by our study were:

1. *What will future steam demand be?*

2. *Should we supplement existing equipment, or build an entirely new plant?*

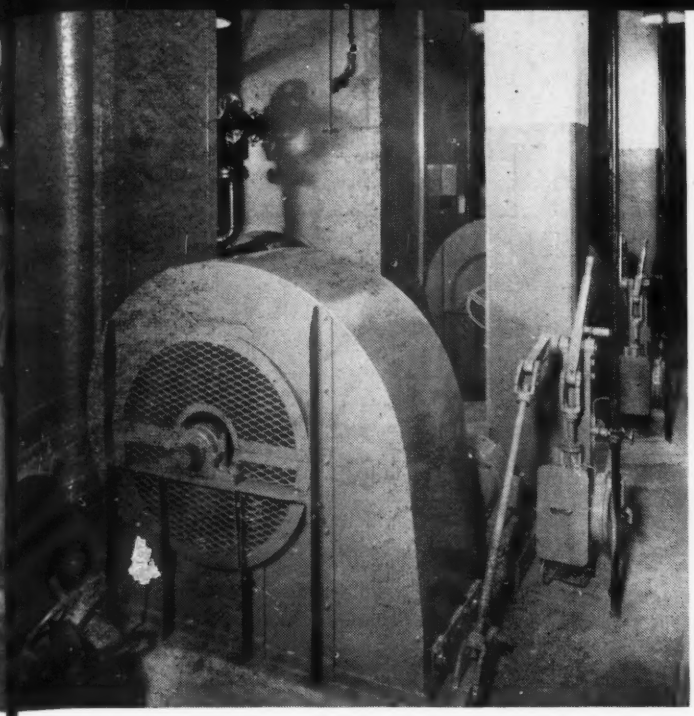
3. *What size and type of equipment should be installed: Which fuel? What type of boiler? What kind of auxiliaries? How much control and metering equipment?*

4. *How should equipment be arranged?*

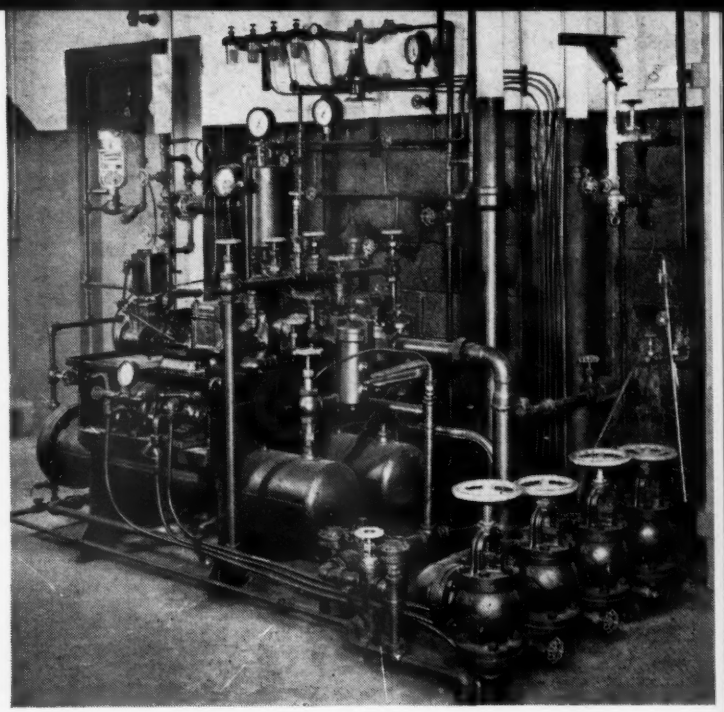
The existing boiler plant, which had one 1500-sq-ft return tubular boiler, had been extended a number of years ago by the addition of a 750-sq-ft Scotch marine unit, and hogged-fuel firing had been replaced by oil burning. It was found that determination of steam demand on the existing plant was practically impossible. Proposed extension of the laundry facilities further complicated the picture so we decided that future steam demand would have to be established by independent calculation.

Estimating Steam Load. American Linen Supply is a member of the American Institute of Laundering, whose research department has compiled data on steam consumption of the various laundry machines and issued recommendations on boiler-plant requirements. We thus predicted steam demand from the proposed laundry equipment, using the steam consumptions in the *American Institute of Laundering Guide*. The table gives the tabulated calculation.

This estimate showed an average de-



FORCED-DRAFT FANS, at rear of boilers, are motor-driven; air volume is regulated by automatically controlled dampers



FUEL-OIL HANDLING SET consists of motor-driven centrifugal pump and a duplex unit, U-tube heaters, strainers and valves

in Layout of Laundry Boiler Plant

mand of about 17,000 lb per hr. To meet this figure, we selected two units each having a maximum continuous capacity of 19,500 lb per hr and a 2-hr peak capacity of 20,500. This left some room to grow, and provided for 100% standby so maintenance and inspection can be carried out during the normal work week instead of on overtime.

The existing boiler plant was in the basement of the main building. Thought was given to retaining existing boilers for standby and adding only one new boiler. As the old units had seen almost 20 years of hard service and were occupying valuable space, we decided to install all new equipment. After looking into the many factors involved, we could see that the equipment should be housed in a new addition to the main building rather than in a separate boiler house.

Fuel Selection. Wartime fuel-shortage experiences were still fresh in our minds. Thus type of fuel to be burned in the new plant was of primary concern. In Seattle and throughout the Northwest, many plants burn wood refuse (hogged fuel) and sawdust, usually on flat grates in dutch ovens. Our plant did this at one time but was converted to oil firing. During the war it looked as if we would have to go back to hogged fuel, but fortunately the oil situation changed before this heavy expense became necessary.

After considering the relative economies of hogged fuel, coal and oil, we decided to stick with oil firing for the new units even though it could be shown that on a Btu basis other fuels were cheaper. Lower first cost and operating-labor cost swung the final decision to oil.

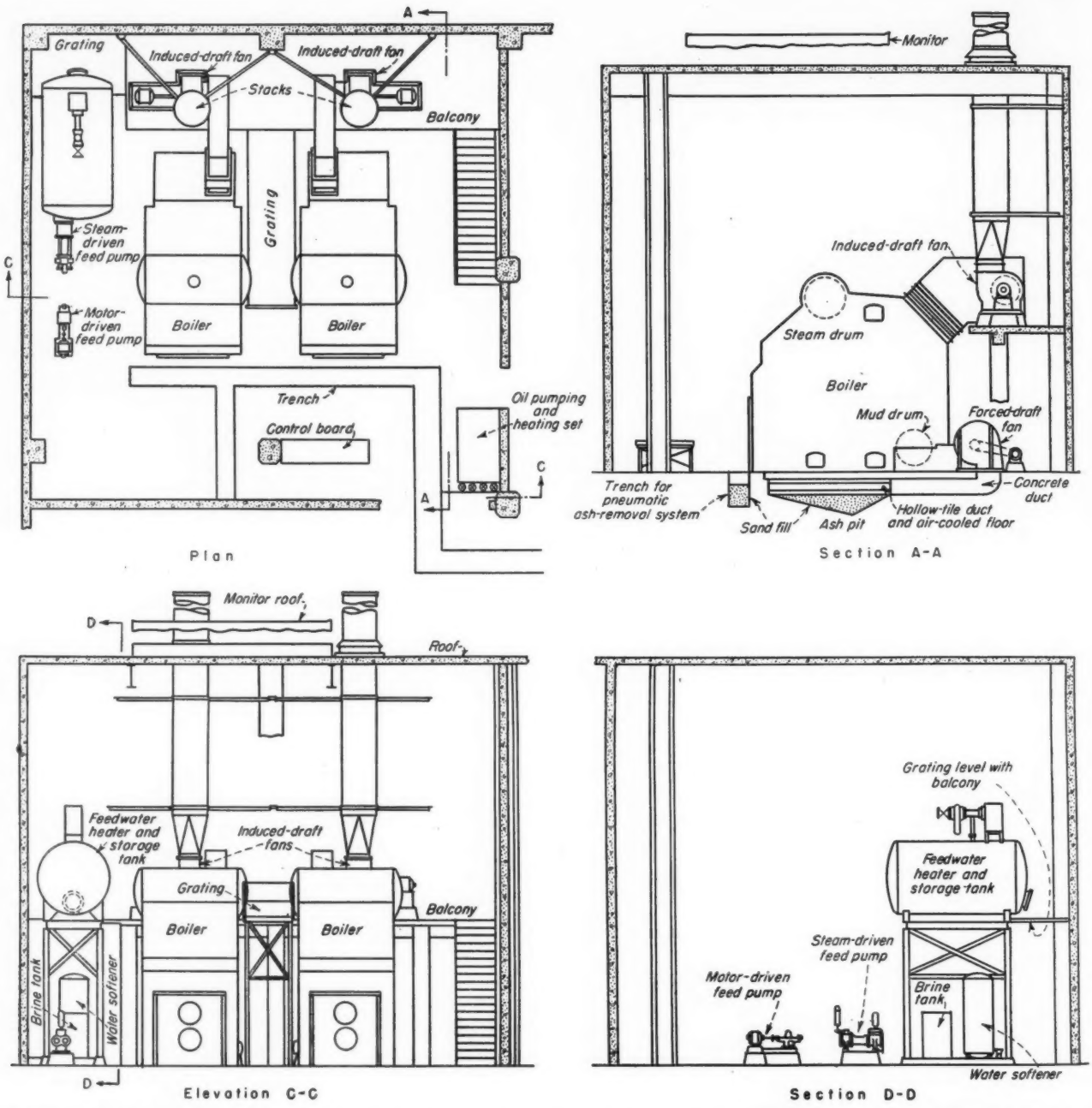
Boiler Installation. In selecting the boilers it was determined that modern steel-encased high-efficiency watertube units of the integral-furnace type were most suitable. Even though steam was to be produced at 135 psi, 250-psi boilers were chosen. The very small increase in capital investment was warranted in view of possible future use of generating equipment, changes in laundry techniques, and better resale value.

Although the initial installation involved oil firing with wide-range burners, foundations for the boilers were

ESTIMATED PLANT STEAM LOAD

No.	Equipment	Steam consumption, lb. per hr: Each unit	Total
9	36x30-in. tumblers	130	1,170
1	42x90-in. tumbler	480	480
26	Pony presses	15	390
54	Combination bosom-body presses	50	2,600
1	Shirt unit	130	130
2	30x120-in. 2-cylinder flatwork ironers	500	1,000
1	6-roll x 120-in. flatwork ironer	350	350
3	Starch cookers	30	90
1	Stocking form	15	15
2	Puff-sleeve forms	15	30
1	Mixing jet	30	30
	Direct steam in washroom	Assumed	385
	Building heating and line losses	.....	330
1	15,000 gal-per-hr hot-water heater from reclaimer to 180-deg F	.....	10,000
	Total steam consumption		17,000

Compiled from information obtained from Special Report No. 146, *The Determination of Laundry Power-Plant Requirements,* American Institute of Laundering.



PLANT LAYOUT in plan, elevation and sections: note spaciousness and arrangement of equipment in well-defined working areas

provided with ashpits, which were filled with sand underneath the air-cooled floor for oil firing. The forced-draft fans were placed at the rear of the boilers, discharging into concrete ducts and through the air-cooled floors to the burner fronts. Thus if it becomes necessary to change to coal, gas or wood-refuse firing, forced-draft fans and boiler foundations need not be changed. A trench with cover plates was provided in front of the units so that a pneumatic ash-removal system could be installed without building changes.

To provide safety factors, different feed-pump drives were installed: one pump is steam driven, the other motor driven. Plant heat balance is such that steam from the feed pump can be used in the feedwater heater. All remaining auxiliaries are electrically driven.

Duplex design was also applied in the oil pumping and heating set. It consists of one motor-driven heavy-fuel-oil pump, one horizontal duplex pump, and two U-tube fuel-oil heaters. In addition, to provide for lighting off each morning after boilers have been shut down all night, and for starting on Monday morning after the weekend shutdown, a small diesel-driven geared oil pump was installed for furnishing oil to the burners.

Auxiliaries. In selecting auxiliaries, we examined each item on the basis of its economic justification. Some items were justified on the basis of fuel saving, others on labor saving or from a safety standpoint.

This was particularly true of combustion-control and metering equipment. With heavy fuel oil costing $2.65 delivered to the plant it was easy to show that fuel saving alone warranted a

steamflow-airflow type combustion control. While the feedwater-regulating system could probably have been justified on fuel saving alone, safety features made the installation a "must."

By agreeing to install fuel-oil tank-level indicators, permission was obtained to locate four 6000-gal fuel-oil tanks underneath the basement floor of the new building addition rather than under the driveway at the rear of the building. The saving in piping alone almost paid for the indicators.

While city of Seattle water runs low in hardness and has been handled successfully with internal treatment, a water-softener installation proved particularly desirable as the makeup requirements varied widely during the day, making it difficult to proportion chemical feed. It was found that a zeolite softener with supplemental phosphate feed could be justified in this case by savings in chemical cost.

Equipment Arrangement. We firmly believe that conveniently arranged equipment receives better care with a resulting increase in operating efficiency and reduction in maintenance cost. While we realized that our plant would not be large by the standards of the central-station industry, we felt that it warranted the effort and thought required for making studies and plans concerning even minute details of valve location, etc.

Work areas were decided on as follows—*Ground floor;* control area, fuel area, feedwater area, fan area. *Balcony:* valve area, fan area, feedwater area.

We centralized the control area around the panelboard directly in front of and facing No. 2 boiler. This panel carried all automatic combustion-control elements, draft, steam-pressure, fuel-oil pressure and water-pressure gages, and pushbuttons for starting every piece of electrical equipment in the boiler room. With the control board immediately in front of the boiler, burners and controls are in the same area—a convenience for lighting off and regulating the burners when cutting the boiler in on the line.

The fuel area includes the oil pumping and heating set and valve manifolds, supplying heating steam to the tanks and controlling suction from them. Also located in the fuel area are the suction and discharge-oil strainers and the bubbler system for the fuel-oil tank-level indicators.

As shown on the plan and sections, brine tanks and water softener are set on the ground floor, under the platform carrying the feedwater heater and storage tank. In the same area we placed the two feed pumps.

Upper-Level Access. The ground floor, the center of activities in the plant, is adjacent to the garage and repair shop. The balcony (see layout drawings) opens onto the main laundry working area and connects directly to the press room. For this reason we thought it desirable to install a concrete stairway from the ground floor to the balcony for easy, convenient access.

One boiler was set right-hand and the other left-hand, with an open grating platform in the space between, at the level of the balcony. This gives easy access from the balcony for servicing the automatic feedwater regulators, the soot-blower control valves, gage glasses, water columns and automatic fuel-cutoff mechanism, and for operating the nonreturn valves and the header stop valves.

We placed the feedwater-storage tank and the deaerating heater in an area that forms an extension of the concrete balcony. Also located there are the reducing valves furnishing supplemental steam to the feedwater heater. Access to the building-heating line and the main stop valve controlling steam to the entire laundry is from the concrete balcony. Induced-draft fans, with their stub stacks, also mount on the balcony.

Operating Results. Operation of the plant has more than justified the extra effort that was put into working out a good arrangement. We believe we have an attractive, efficient plant with rugged, simple equipment, obtained at minimum capital expenditure. Actual steam loads closely parallel those predicted in the preliminary studies. The new, highly efficient boilers have already produced a major saving in fuel. Also, laundry production has increased because there is an abundant supply of clean, dry steam of adequate pressure at all times.

PRINCIPAL POWER-PLANT EQUIPMENT

American Linen Supply Co, Seattle, Wash.

Boilers, 2.....The Babcock & Wilcox Co
Two-drum, integral-furnace 19,500 lb per hr (24-hr continuous capacity), 250-psi working pressure, operated at 135-psi, 1944-sq-ft heating surface, 470-sq-ft waterwall surface.

Oil burners, 2 per boiler.....The Babcock & Wilcox Co
Y-jet wide-range forced-draft steam-atomizing burners; 8-to-1 range with 100-psi oil and 125-psi steam.

Safety valves, Consolidated.....Manning, Maxwell & Moore, Inc

Boiler nonreturn valves.....William Powell Co

Soot blowers.....Diamond Power Specialty Corp
Automatic-valved, rotating units

Blowoff valves .....Yarnall-Waring Co
Direct-acting double-tightening straightway and seatless angle valves

Steam gages, flush, back-connected.....James P Marsh Corp

Feedwater regulators.....Northern Equipment Corp
Copes 1¼-in. regulators for 21,500 lb per hr at 15-psi differential

Feed-pump governors.....Northern Equipment Corp
One Copes 1-in. reciprocating-pump governor for 1000 lb per hr at 8-psi drop; one Copes 2-in. centrifugal-pump governor for 30,000 lb per hr at 15-psi drop

Forced-draft fans, one per boiler.....Western Blower Co
Class HV turbine streamline fan, rated 25,200 lb per hr at 105 F and 3.75-in. static pressure, motor-driven, damper controlled.

Induced-draft fans, 1 per boiler.....Western Blower Co
No. 4½ turbine streamline fan, rated 26,500 lb per hr at 575 F and 0.8-in. static pressure. Motor-driven, vane-controlled

Feedwater heater, 1.....Cochrane Corp
Cast-iron heater top for operation at 3-psi, mounted on 6-ft-diam x 12-ft-long storage tank. Capacity 25,000 lb per hr

Water softener .....Cochrane Corp
2½-ft diam high-exchange zeolite softener with brine tank, meter and single-control valve. Capacity 2800 lb per hr average, 12,500 lb per hr, peak.

Chemical feeder.....Dearborn Chemical Co
Automatic intermittent supplemental phosphate feeder with rotary pump and mercoid timer

Combustion controls.....Bailey Meter Co
Compressed-air-operated automatic combustion-control system of the steamflow-airflow type

Boiler meters, draft gages.....Bailey Meter Co
2 boiler meters, one 6-unit multipointer draft gage

Tank-level indicators.....Bailey Meter Co

Boiler-feed pumps, 2.....Weinman Pump Mfg Co, Leyman Mfg Co
One Weinman 2-in. 2-stage motor-driven centrifugal rated at 30,000 lb per hr at 165-psi; one McGowan 7.5x5x6-in. duplex steam pump rated 25,000 lb per hr at 165-psi.

Fuel-oil pumping and heating set.....Assembled on job
1—DeLaval IMO pump rated 4-gpm heavy industrial fuel oil at 80 F and 150-psi
1—McGowan 3x2x3-in. duplex steam pump
2—Alaskan Copper Co U-tube fuel-oil heaters, each capable of raising 2000-lb-per-hr fuel oil from 80 to 200 F with 5-psi steam
2—Chas M Bailey ¾-in. steam-control valves
2—Chas M Bailey duplex pressure strainer
1—Tagliabue oil-temperature controller

Reducing valves .....Clark Mfg Co
One type CRV 135 to 2-psi with plus or minus 1-psi variation on the feedwater heater

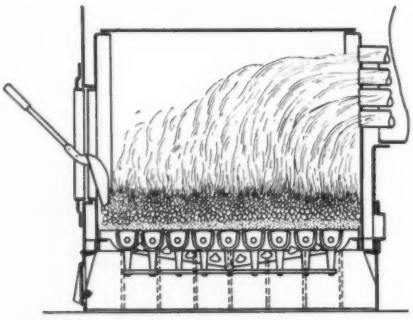
Traps 2, ¾-in., inverted bucket.....Clark Mfg Co

Refractories .....Gladding McBean Co

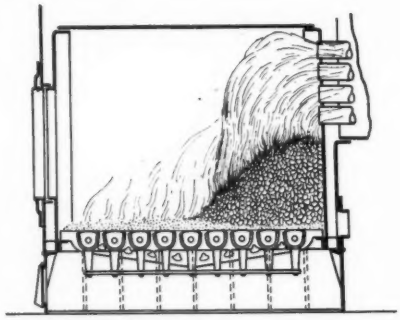
Insulation contractor.....Chas F Brower Co
Philip Carey Hi-Temp block and 85%-magnesia pipe covering

Metal protection.....Dampney Co of America
Apexior No. 1 for internal boiler surfaces; Apexior No. 3 for water softener and cold-water tanks; Thurmalox No. 7 for stacks, fans, headers, boiler doors and boiler fronts

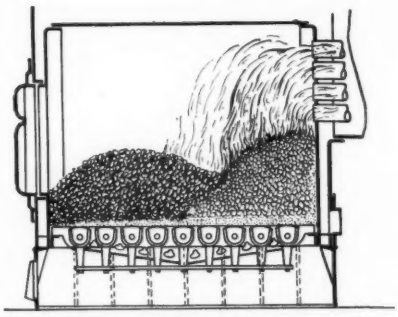
1: Correct Hand Firing Cuts Smoking



COKING METHOD gives good efficiency, little smoke; shown above, ready to fire



PUSH LIVE COALS to rear of grate. This makes way for piling up the fresh coal



ADD FRESH GREEN COAL at front of furnace. The volatile distills off slowly

Proper Hand Firing Makes

Care and attention to long-known operating methods can stop hand-fired boilers from smoking way out of proportion to their size. Here are steps to take in feeding and firing coal from recommended fuel thickness to cleaning fire for good results

►FIRING COAL on fuel beds can be accomplished mechanically (POWER, March p 88, May p 84) or manually. Even though mechanical firing (1) extends the range of suitable coals and (2) gives an estimated 10-20% fuel saving, hand firing still finds limited service in the power field. As a rule this service applies to units of steaming capacities up to about 8000 to 10,000 lb per hr, and its fuels include all those common to the power field—from anthracite through bituminous coals.

Firing Methods. Firing coal by hand involves more than just scooping it from a convenient pile and tossing it into the furnace. Poor firing can cause these comparatively small units to smoke way out of proportion to size. There are three generally recognized and accepted methods for good firing: (1) coking (2) alternate or strip (3) spreading.

But let's look first for some directions that fit all usual power-field coals. Hand firing amounts to a primitive form of overfeed firing. In it fresh coal lands on the top of a live fuel bed. Ignition begins, then, at the top. Coal burns down to ash.

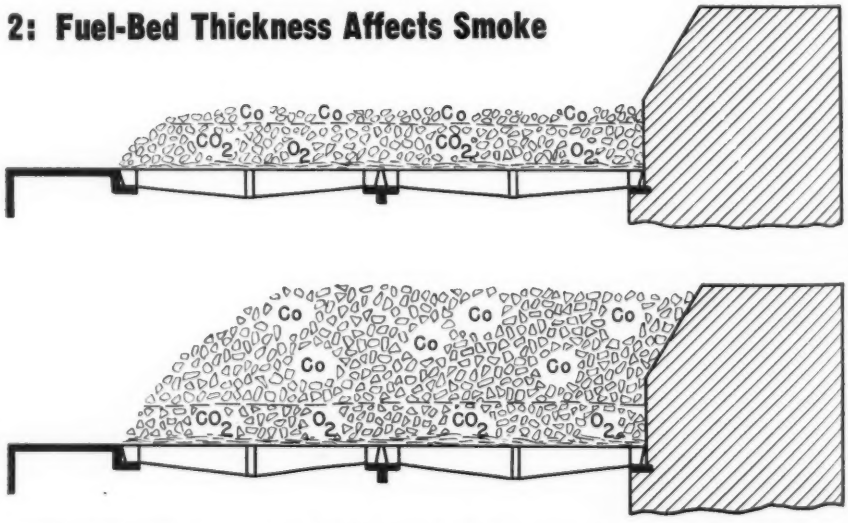
Its progress from fuel-bed top to final removal as ash depends upon (1) firing rate (2) fire-cleaning time.

If grate is a movable or shaker type, the ash leaves by gravity. If stationary, ash is removed by hoe. Rate of ignition should control both firing and cleaning periods. Of course, with a loose control of feed rate for incoming coal, ash-removal rate is also haphazard. Under such an arrangement combustible loss in refuse runs high.

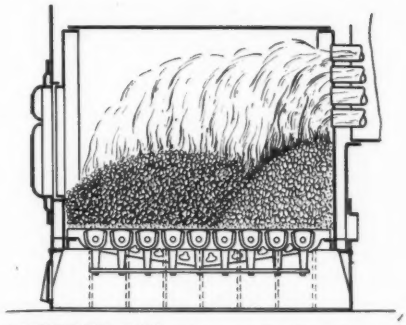
Incoming coal on the surface of the fuel bed has its temperature raised by radiation largely. Once ignited, it warms by contact any green coal lying beneath. The whole ignition process continues apace if air flow through the fuel bed is about right. If uncontrolled air gets over the fire through leakage or too frequent and too long openings of the firedoor, it slows down ignition rate because it cools furnace surroundings.

Control of Air. Air-flow rate in hand-fired furnaces has to be a compromise. In brief, there are no zones where fuel

2: Fuel-Bed Thickness Affects Smoke



THIN FUEL BED (top) and thick one (below) show how air passes through beds. With thick bed it gives (1) thin oxidizing zone (2) thick ash-heavy reducing zone



DISTILLED GAS mixes with the air over the hot coals to give a good combustion

No Smoke

By L N ROWLEY
Managing Editor
and
J C McCABE
Associate Editor

bed is kept constantly the same so gas coming off can be classed as rich, perfect or lean. (There is some approach toward zoning in the coking method of hand-firing.) All this means that control of air flow through the fuel bed consists mostly of keeping fuel-bed resistance about the same, on the average, across the grate surface.

Best results come from maintaining thin, even fuel beds. To keep a fuel bed this way means frequent firing, with only light amounts or thin layers of coal. Never cover a fuel bed completely with fresh fuel.

Keep the ashpit door open. Control draft by regulating stack damper and not by closing off fresh-air supply. Next, avoid refuse piling up in the pit. Any sizable accumulation upsets even air distribution to the fuel bed, and causes overheated ashpits, grates and ash bed.

Now for a closer look at firing methods. Coking consists of piling fresh coal in the front part of the furnace, Fig. 1. This allows volatile to distill off slowly. The distilled gas passes over the hotter part of the fuel bed on its way to the furnace outlet.

In this way the gas has its temperature raised, joins with air passing through the fuel or admitted over the fire, to be completely burned before leaving the furnace.

Remaining coke at the furnace front is pushed back over the grate for final burning. A fresh supply of green coal takes its place for coking. Where combustion rates do not run too high, fairly good operation results. But under high rates of combustion, operators tend to push coal back too soon. This moving of partially coked coal causes emission of smoke.

Alternate Firing. The second or alternate method of hand firing might be considered a variation of the coking one. Green coal is thrown first to one side of the furnace. As volatile matter distills off it combines with air passing through the live side of the grate. Finally the remaining coke ignites and combustion proceeds. Fresh green coal is admitted to the former live side—by now fairly well burned down. This differs from the purely coking method in that burning coke is never moved back. The cycle is repeated.

The strip method is a variation of the coking method. It applies principally to wide furnaces. In effect it amounts to a refinement of the alternate one discussed above. Here half the grate is fired at one time but not solidly.

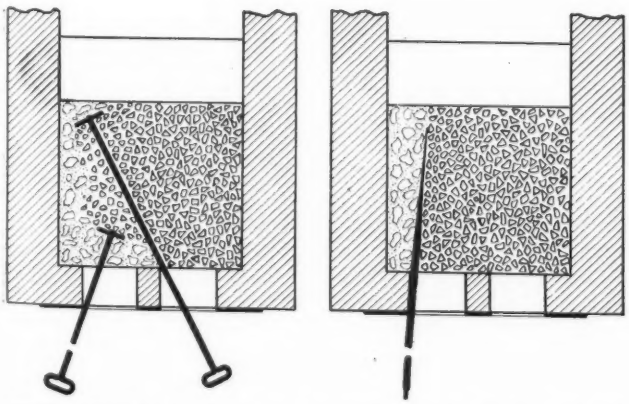
The grate divides into three, four or five strips of coal reaching from firing door to bridgewall. Alternate strips of live fuel lie between these layers of green coal. Each side strip, whether green coal or live fuel, has as its neighbor a strip of opposite nature. Center strips have live fuel along each side. Such a distribution is said to give a better mixture, higher furnace temperature, more even fuel bed than the alternate system.

Spread Firing. Spread firing means throwing coal over the entire grate—as uniformly as possible. Some authorities prefer an alternate sprinkling of light amounts. Others suggest light, frequent firing, while concentrating also on keeping fuel-bed holes covered. This system permits higher combustion rates but can lead to greater smoke troubles if too much coal builds up in a section of the fuel bed.

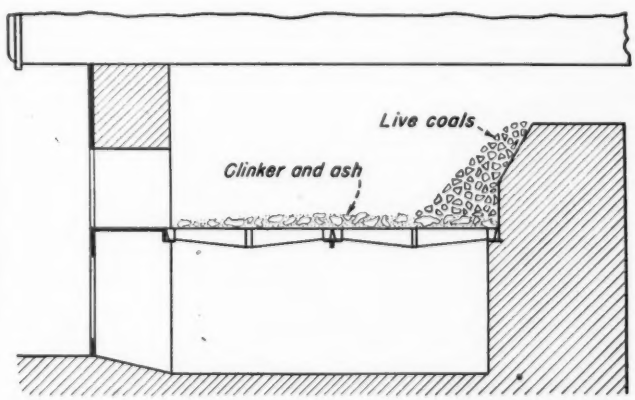
Grate structure has some bearing on firing method employed. Hand-fired furnaces may have level or inclined grates. Level grates may be stationary or movable. Inclined grates should be movable only although a few stationary ones are still in use. A special furnace acting on a down-draft principle has two grates.

Level grates permit a choice between spreading or coking forms of firing;

3: Correct Cleaning Improves Firing



SIDE METHOD of cleaning fire uses hoes (left) or slice bar (right) to move burning coals to one side and expose clinker



FRONT-TO-REAR METHOD pushes burning coal back against the bridgewall so that clinker and ash can be pulled out the door

the inclined grate operates under a coking system only.

With an inclined grate, furnace coal is fired at the front and top of the incline. Movement of the grates by hand levers pushes the coal as it is coking down the incline; at the bottom, unburned refuse collects for dumping into the ashpit.

It is smart operation to allow ash and unburned carbon on the dump grate enough time to burn out combustible. An effort should be made to keep this area level and free from holes. One frequent source of loss with this type furnace is moving grates too often. This action lets unburned coke fall into the ashpit. In addition, unnecessarily disturbing the bed gives off smoke.

Down-Draft Furnace. How about a down-draft furnace? All coal is fired on the top grate. Here it gives off its volatile as it cokes. Air flows downward through the green coal on the top and the hot coke underneath. This mixed air and volatile stream passes through the upper grate down into the burning space between upper and lower grates.

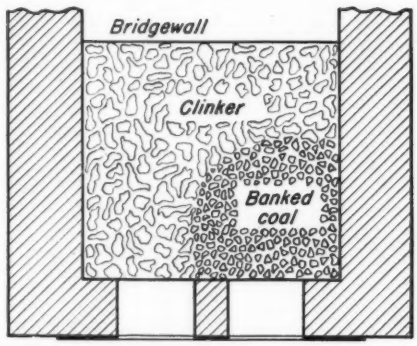
The lower grate carries a bed of hot coke made up of pieces fallen through or knocked down from the upper grate. Air for this second fuel bed comes up from the ashpit through the coke bed into the mixing area between the two grates. This meeting and mixing of two oppositely flowing gas streams results in turbulence and good combustion.

Most ash collects on the lower grate. From here it is removed as from a single grate. The upper grate sometimes clinkers if coke is not "sliced off" at frequent intervals.

Let's get down to cases on suitable fuels and recommended thickness of fuel bed. On the matter of fuels the inclined grate finds soft coals, which do not cake readily, suitable fuel. The down-draft type of hand-fired furnace needs a soft coal of appreciable caking quality to insure holding a fuel bed on the upper grate. In addition, it should be of a size where initial charge stays on this upper grate. If there are too many fines they fall through and smoke; flue dust could result.

Coal Selecting. Level grate units usually employ the coals of the region because they are (1) readily available and (2) often cheaper for the quantities ordered. Sizing of coal is important but mostly from the standpoint of personnel experience. Plants burn everything from run of mine down to slack. Wherever damper control can be well regulated, partially screened nut coal seems to give fairly good results. Heavy

4: Banking Method



BANKING A FIRE by this method allows clinkers along bridgewall to cool off

percentages of slack entail special firing methods, and good control of draft. Moreover, a close supervision must be exercised or smoking becomes a problem. Firemen prefer a coarse fuel.

Now for thickness of fuel bed. It varies, of course, with coal quality, size, available draft and steaming load. The heavier the load, the thicker the bed. With a run-of-mine bituminous coal on a standard flat grate, where a draft of about 1 in. of water exists in the breeching, fuel-bed thickness runs 4 to 8 in.

If coal is predominantly coarse with very few fines, fuel-bed thickness approaches the upper limit of 8 in. If coal runs mostly small pieces and slack, hold fuel bed nearer 4 in. Double-screen coal is desirable.

Many firemen reason that heavy fuel beds spread out the time between firing. But this reasoning makes the smoke problem from hand-fired units far more serious than it need be.

Clinker Trouble. Thick fires cause troublesome clinker as often as all other causes put together. The thicker the fuel bed, the greater the extent of the reducing zone, Fig. 2. Fusion temperature of ash is lowered in a reducing atmosphere. Add to that the fact that incoming cool air and gas velocity through a thick fuel bed run much less than through a thin one, and the result is for ash to tend to melt and clinker with a thicker fuel bed. On the other hand, carrying too thin a fuel bed may lead to holes blowing through, particularly if overfire draft changes suddenly. Thus the spread method needs constant attention.

Second ranking cause for clinker and smoke difficulties is the stirring up of a fire with a slice bar. Ashes and small clinkers get up into the active section of the fuel bed where they run together to form large, troublesome clinkers. In fact, caution should be the watchword when raking or leveling a fire so as not to bring ash up into the hotter zone.

Another clinkering factor comes into being when a fire is shaken down too much. Live coals fall into the ashpit where they continue burning. They heat up the grate as well as the first few layers of ash on the grate.

When an ashpit door is closed it cuts off the supply of cool air passing through the grates. It may be enough to raise grate temperature to where clinkering develops.

A heavy percentage of slack coal can indirectly lead to clinkering. Slack tends to mat over and, in breaking up the mat, the fire is stirred up so ash gets up into the active zone.

Cleaning Fires. Since stirring the fire can cause so much trouble it follows that there are approved ways of cleaning a hand-fired fuel bed. Where grates are movable cleaning problems are lessened. But on flat grates two procedures are considerd good practice. The first is called the side method and the second the front-to-rear method. Both are done with the damper partly closed.

The side method cleans one side of the fire at a time. Good coal is scraped and pushed to one side, Fig. 3. Clinker and ash left behind can be pulled out with a hoe. If clinker sticks, a slice bar run under it loosens it. Usual procedure is to hoe up all ash and clinker to the front of the furnace before cleaning.

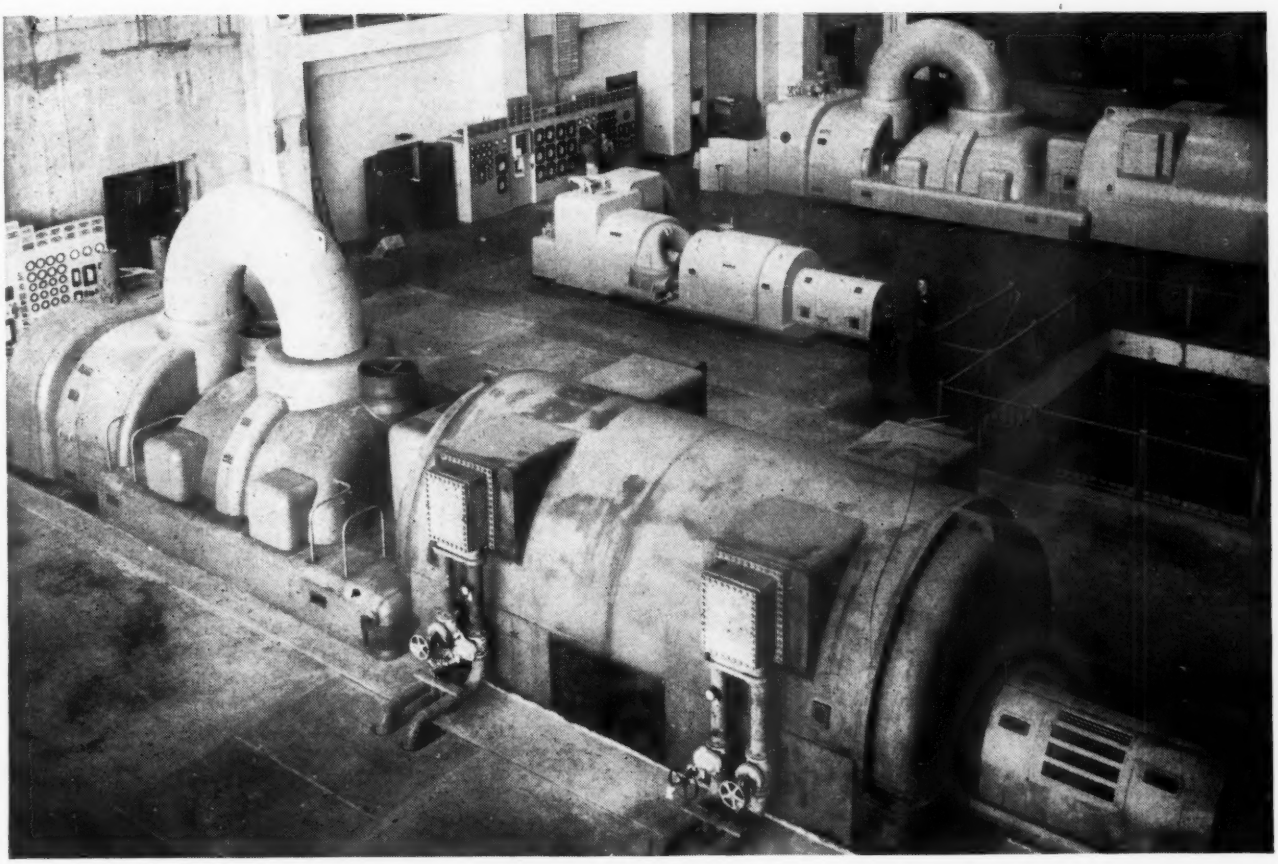
Burning coals are returned to the clean grate by slice-bar action. The hoe spreads and levels these live coals out. Fresh coal is added to build up the fire. The second half of the grate surface is cleaned in the same manner.

With the front-to-rear method of cleaning, Fig. 3, all burning coal is pushed back against the bridgewall. After the exposed clinker is loosened all ash and clinker are pulled out for final disposal. Burning coal is next pulled forward over the clean grate and leveled out. Fresh coal is added.

The front-to-rear method of cleaning, while quicker, is not so satisfactory as the side one. Some clinker always stays against the bridgewall. In time this clinker grows.

Other methods of cleaning seem to aggravate clinker and fuel-bed disturbances. They amount to stirring up a fire bed and producing byproduct smoke and combustion problems.

Smoke troubles can often be reduced by proper use of overfire air. The next article in this series will discuss overfire jets and their construction.



1 Units 1 and 2—65,000 kw each, 900 psi, 915 F—are designed to withstand extreme shock and for quick pickup. Each requires 1,125,000 lb steam per hr, which after leaving the turbine is guided to two condensers by a connecting piece

Welding Saves Million Dollars A Year at Harbor Steam Plant

Fabrication of the many important parts that make up a power plant consumes time, labor. Carl N Barlow shows how welding saved big money by speeding up erection, making it compact*

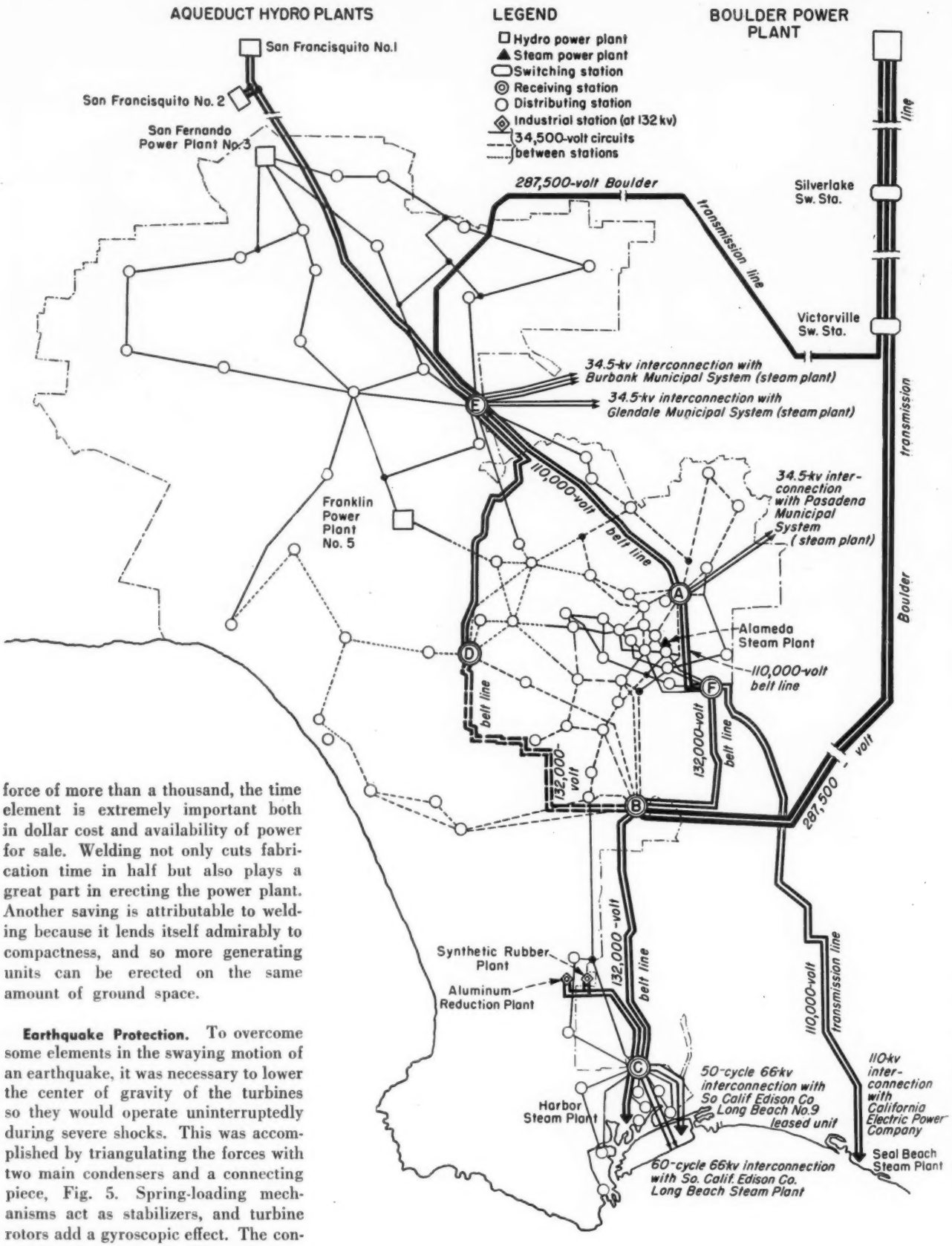
▶ The City of Los Angeles Dept of Water and Power, Power Division, is engaged in a major construction program installing a total of five units in the Harbor Steam Plant, Fig. 1. This addition will improve the power aspect from Boulder Dam, Fig. 2, and make excess impounded water in Lake Mead available to Nevada, Arizona, New Mexico and southern Utah for irrigation. Urgency of the war years made it necessary to use all the electrical power available from this source for the gigantic aircraft and wartime installations in southern California, but this water is badly needed by all these states. Boulder Dam is now known as Hoover Dam.

Load Increase. Engineering Inspection Section of the Design and Construction Division is contracting for and ordering over $9,000,000 worth of material for Harbor Plant. This does not include industrial and residence installations, an equal amount, which are sorely needed for the fast-growing metropolis. Population of Los Angeles has increased over 500,000 in five years, Fig. 3, and each month of this period about 150 industries have established plants or offices. Thus a tremendous task of providing facilities has fallen on the municipally owned Dept of Water and Power.

Savings. Welding design is saving the department over $1,000,000 a year in fabrication of various pieces of power equipment, Fig. 4. With a construction

* Carl N Barlow is Mechanical Engineering Inspector of Design & Construction Div, Power System of the City of Los Angeles.

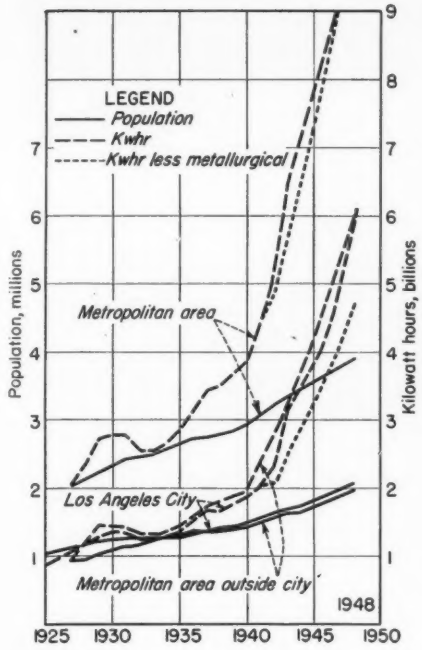
Welding data and illustrations are from a study submitted to The James F Lincoln Arc Welding Foundation in its recent $200,000 Design-for-Progress Award Program, for reports, advances and improvements made by the application of arc welding in design, fabrication, construction and maintenance.


AQUEDUCT HYDRO PLANTS
San Francisquito No.1
San Francisquito No. 2
San Fernando Power Plant No. 3
LEGEND
Hydro power plant
Steam power plant
Switching station
Receiving station
Distributing station
Industrial station (at 132 kv)
34,500-volt circuits between stations
BOULDER POWER PLANT
287,500-volt Boulder transmission line
Silverlake Sw. Sta.
Victorville Sw. Sta.
34.5-kv interconnection with Burbank Municipal System (steam plant)
34.5-kv interconnection with Glendale Municipal System (steam plant)
Franklin Power Plant No. 5
110,000-volt belt line
34.5-kv interconnection with Pasadena Municipal System (steam plant)
Alameda Steam Plant
110,000-volt belt line
132,000-volt belt line
132,000-volt belt line
287,500-volt transmission line
Boulder
Synthetic Rubber Plant
Aluminum Reduction Plant
132,000-volt belt line
110,000-volt transmission line
Harbor Steam Plant
50-cycle 66-kv interconnection with So Calif Edison Co Long Beach No.9 leased unit
110-kv interconnection with California Electric Power Company
Seal Beach Steam Plant
60-cycle 66-kv interconnection with So. Calif. Edison Co. Long Beach Steam Plant

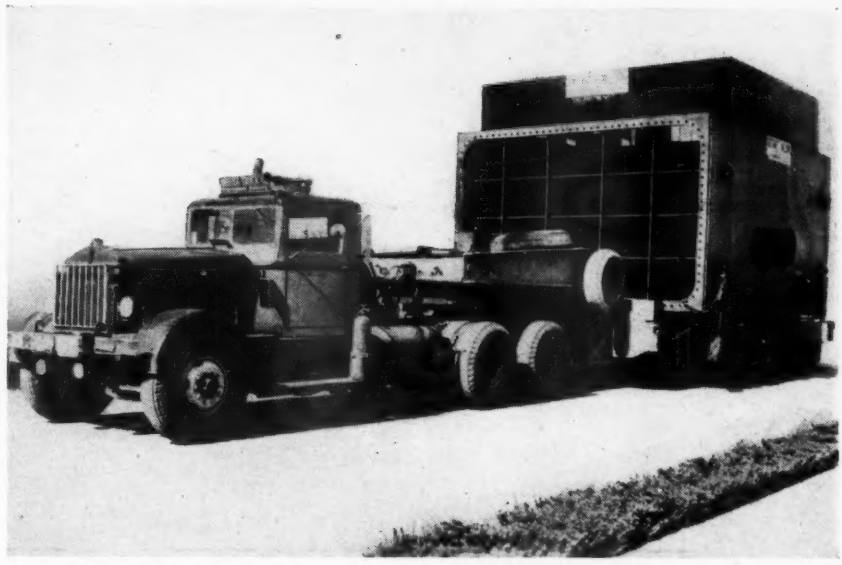
force of more than a thousand, the time element is extremely important both in dollar cost and availability of power for sale. Welding not only cuts fabrication time in half but also plays a great part in erecting the power plant. Another saving is attributable to welding because it lends itself admirably to compactness, and so more generating units can be erected on the same amount of ground space.

Earthquake Protection. To overcome some elements in the swaying motion of an earthquake, it was necessary to lower the center of gravity of the turbines so they would operate uninterruptedly during severe shocks. This was accomplished by triangulating the forces with two main condensers and a connecting piece, Fig. 5. Spring-loading mechanisms act as stabilizers, and turbine rotors add a gyroscopic effect. The connecting piece not only allows the generating units to operate in an earthquake, but also serves to split steam flow as it changes to condensate within

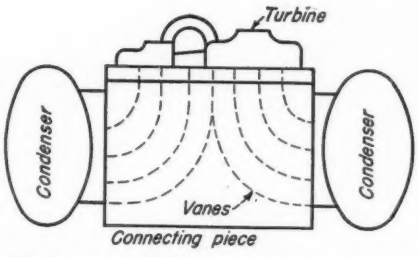
2 Completion of five units of Harbor Steam Plant is expected to improve Boulder Dam water and power use, and will make the excess available for other states



3 500,000 population increase brings with it the need for additional power



4 Welding the connecting piece made a considerable saving in its cost, but transportation of the bulky part from shop to erection site needed careful planning



5 This arrangement lowered the turbine center of gravity for greater safety

the condensers. Vanes, welded inside the structure and acting as turning points, give centrifugal motion to the steam, which causes it to return more rapidly to the liquid state.

The connecting piece, Fig. 4, fabricated by Southwest Welding & Mfg Co of Alhambra, Calif., was transported complete 30 miles to the erection site. All steel plate is ASTM A-70 except the vanes, which are special hull plate secured from the U. S. Navy. Extreme service requirements justify this special plate; 575,000 lb of water and steam will flow across it each hour for its entire useful lifetime.

ASME Unfired Pressure Code, paragraph U-69, was the controlling fabrication specification and was conformed to at all times. Certified welders were used throughout the entire project and the welding was rigorously inspected. All welds were multiple pass with shielded arc No. 7 rod, and were back-chipped and sealed with ¼-in. seal welds.

Vanes were stagger welded with 3-in. welds spaced on 12-in. centers; this avoided locked-in stresses and also permitted contraction of vanes when cold during shutdown and overhaul. Fig. 4 shows the completed unit loaded and ready for transportation to the plant. Costing $15,000, the connecting piece measures 15x15x16 ft and weighs 42 tons.

Transportation of such a large object presented many problems. Special permits were obtained from the California State Highway Dept, and a traffic escort was provided to clear intersections along the designated route. The truck had to make wide detours around heavy traffic and suburban cities because the bulky load would not clear bridges and street-car electric lines.

On arrival, the connecting piece was placed inside the turbine footing with the 125-ton lift crane, which is part of the turbine-bay installation. Only one-inch clearance is allowed for placing. One entire side of the footing is left open to facilitate moving this bulky item and help align it with the turbine.

Final Connection. Exhaust flange and 24-in. bleed line were tack welded at the time of fabrication; after placing the turbine and seating the gaskets they were solidly welded in place. If adjustments are necessary the tack welds can be broken and relocated at the desired point before final welding. After placing the turbine, the one-inch clearance space is filled with a ⅞-in. fillet weld, making the turbine and connecting piece a true finished assembly. The turbine may be removed, however, by taking out the stud bolts connecting it to the flange and those in the 24-in. bleed line.

If fabricated with rivets or bolts the connecting piece would have cost about double that of the welded structure. Other disadvantages are: (1) time and number of workmen required for erection (2) subsequent loosening of bolts or rivets when the plant is shut down, and the turbine and connection are cool (3) clearances required to erect and couple the riveted or bolted piece to the turbine.

Welding Advantages. One of the greatest points in favor of welding in modern steam-electric generating plants is the fact that it lends itself admirably to compactness where space is at a premium. The shorter the piping, the less friction in the line and the greater the over-all efficiency of the plant. This means dollars to the operators.

Greatest point to consider is the fact that units joined by welding are integral, and the joint is tight whether hot or cold. There are no obstructions because the weld finishes smooth; therefore it introduces no joint friction computations. No clearances are required for placing or removal, as with bolts and rivets.

Steam-design engineers, aware of the possibilities of redesigning present units with welding, are continually revising their plans to incorporate this modern method in construction procedure. Thus they save the costs involved in more lengthy practices.

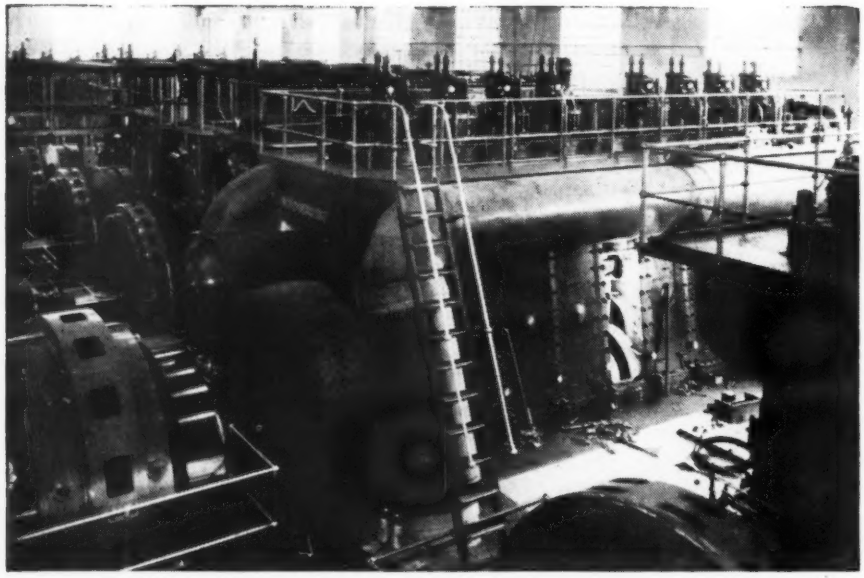
FRONT VIEW shows diesel power plant in foreground, steam plant, now used as standby, at rear. Diesel plant was built in three stages: four bays in center were erected in 1931, two at left of entrance in 1937, three at right just completed

Extension Ups Grand Haven Diesel Plant

Addition of 3850-hp engine makes Michigan municipal largest in U. S.; thorough study reveals advantages of diesel generation; proposed future development to provide about 23,000 hp

By J BRYAN SIMS

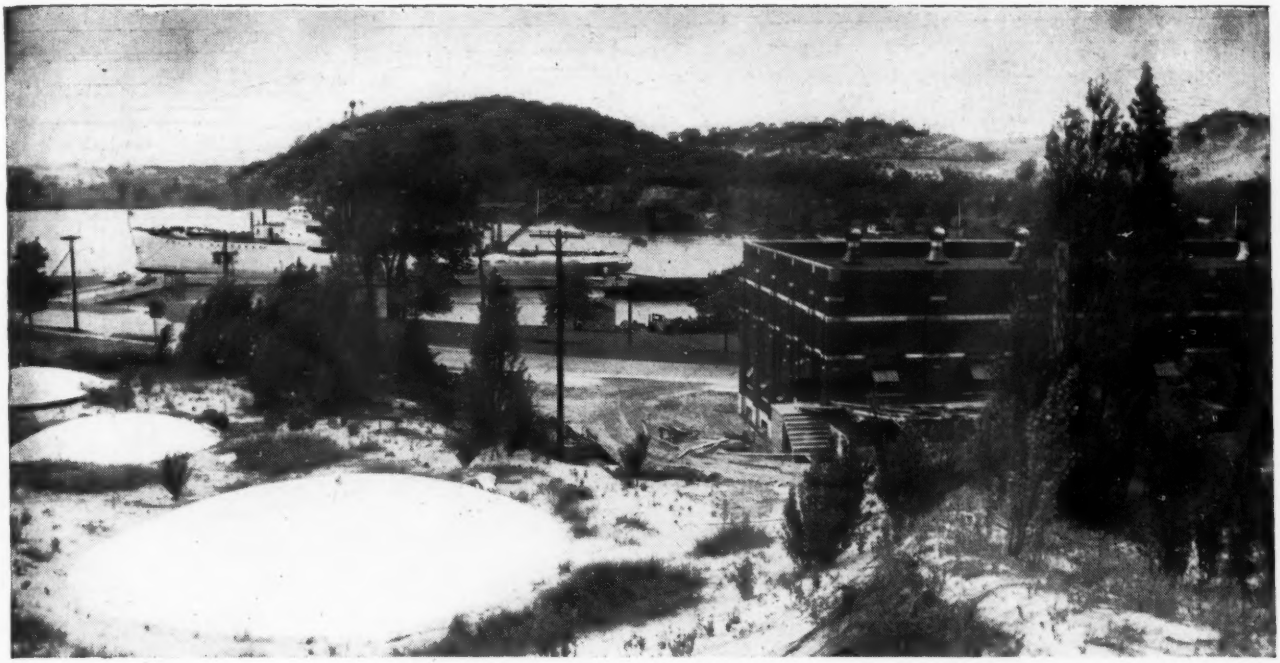
Superintendent — Engineer
Board of Public Works
City of Grand Haven, Michigan



ENGINE ROOM: In foreground is 2250-hp engine installed in 1937, followed by 3850-hp unit of 1941 (piston being pulled), three 1140-hp engines (1931-34), new 3850-hp unit at far end. Space beyond new unit available for similar generator set

▶ MARKING ANOTHER MILESTONE in its more than 50-year history, the Grand Haven, Mich. municipal diesel plant has just completed an extension, which brings its present capacity to 13,370 hp, believed largest in U. S., and provides for another similar unit to lift total to 17,220 hp. As part of the thorough study confirming the wisdom of continuing diesel generation, plans were made for development which would permit installing more than 20,000-hp firm capacity in the building as now extended.

A manufacturing and resort town on Lake Michigan where Grand River enters it, Grand Haven has generated power municipally since 1896. The original steam plant grew until it attained the present 3000-kw capacity in 1928. Increased loads and high production costs led in 1929 to expansion by construction of a diesel power plant southwest of the steam plant (photo



REAR VIEW shows recently built extension with exhaust and intake housing at rear. Diesel icebreaker ***Mackinaw*** is lying in Grand River nearby. Fuel-oil-storage tanks are buried in sand: 150,000-gal tank in foreground; others are 100,000 gal

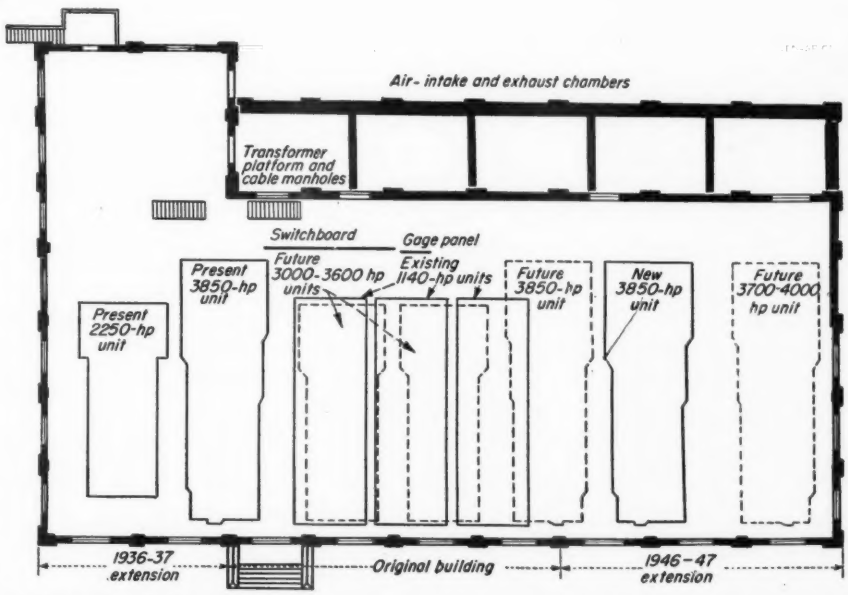
to 13,370 Hp

above). Two 1140-hp 800-kw Baldwin DeLaVergne 4-cycle engines in 1931, were followed by a duplicate in 1934.

Continued load growth led to extending the diesel plant in 1937; the building was added to on the northeast (see photo) and a 2250-hp 1600-kw 2-cycle Nordberg diesel installed. Remaining space in the extension was filled in 1941 by another Nordberg 2-cycle unit, of 3850 hp, 2715 kw.

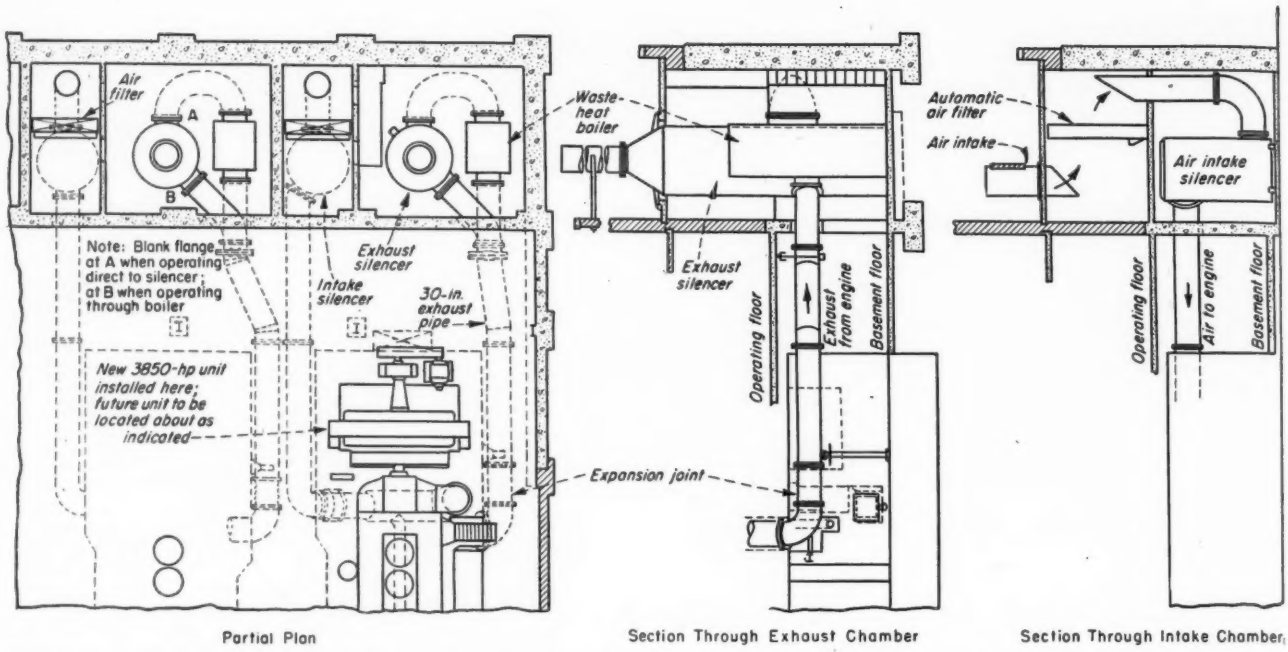
Steam Plant. Since the first diesel was installed, firm capacity (full load with largest unit out) has been inadequate to meet peak demand, and so the steam plant has been maintained as standby. When one diesel is out for inspection or overhaul, steam-plant boilers are held on bank. This is expensive in fuel and also labor, since the layout prevents diesel-plant operators attending the steam plant.

In 1946, in a long-range study to determine how to meet current and future loads, returning to steam generation was examined. But more extensive building alterations would be needed to modernize and expand the steam plant, and the nature of the load worked against economical steam operation. Present load runs from a peak of about 6500 kw at 11:30 am down to 1000-1200 kw in early morning. Most factories do not run extensive night shifts and load drops substantially after 10:00 pm. There was no indication of any general shift in the nature of the predominantly industrial demand.



PROPOSED DEVELOPMENT: Plan reveals location of new 3850-hp unit, space for similar machine, and way in which three existing 1140-hp units might be replaced

Having decided to continue diesel generation, we planned plant extension at the southeast end (see plan). This meant rearranging intake and exhaust facilities for the older engines at this end. The three 4-cycle engines now have their intakes at front of building, with exhaust mufflers at rear, in a housing. Where the old one-story intake and exhaust building stood, we extended



EXHAUST AND INTAKE LAYOUT: Plan and sections show the housing for waste-heat boilers, exhaust mufflers, and intake filters of the new 3850-hp engine and the future unit. This setup gives operators convenient access from operating floor

the plant to install one 3850-hp engine and another similar machine for which specifications are out.

In selecting the new engine, consideration was given to larger cylinder bore but in view of the advantages of having units as nearly alike as possible, we chose a 21½x31-in. 225-rpm 2-cycle Nordberg diesel direct-connected to an Elliott 3390-kva 6900-7200-v 3-phase 60-cycle generator. The present 21x29-in. engine (2250 hp) will be converted to 21½-in. bore, and, since the new unit duplicates the 1941 engine, a measure of ring and piston-head standardization will be effected.

Accessories. Completing the new installation are: 1836-sq-ft 150-psi Foster Wheeler extended-surface waste-heat boiler, Maxim exhaust and intake silencer, Struthers-Wells oil coolers and jacket-water heat exchanger, two Allis-Chalmers 965-gpm soft-water circulating pumps, Blackmer auxiliary oil pump, Dollinger Staynew automatic air filter.

New building extension is 54x57½ ft (craneway) plus an additional 25 ft, 3-in. extension to rear which houses waste-heat-boiler and muffler rooms, air-intake silencer and filter rooms at basement and operating-floor level. Additional space above provides lockers and washroom, chief operator's office and an entrance foyer. A balcony at crane-rail level provides space for cooling-water surge tanks, air-starting bottles, day tanks, etc.

Experience with an arrangement not particularly favorable to operation led us to take pains in designing the waste-heat-boiler and air filter layout. As shown in the drawing, operators have easy access from basement and operating floor to the boiler room. Doors from boiler and muffler room into each section of filter and silencer rooms make these compartments readily available. In the past, snow entrainment in air entering the filter rooms was considerable, the snow covering the filters. Now if this happens, we will open doors between filter and muffler rooms and hot air will prevent icing on screens. Houls louvers on the intake will also help. Similar louvers used in revamping the 4-cycle intakes can be seen under the windows in photo of building front.

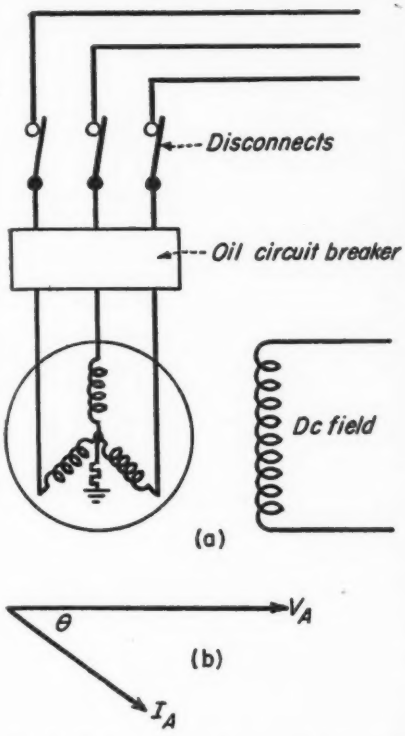
The 1941 and 1948 engines are air-injection units, for which we find advantages when heavy oils are burned. We now use straight-run residual from Michigan refineries, with a viscosity of 500 to 1000 ssu at 100 F. We are burning about 7000 gal per day. Total storage capacity is 770,000 gal: 420,000 in a tank above ground, in the hills and 350,000 in three tanks buried in sandy soil near the plant (see photo). The sand is not particularly corrosive; tanks are stiffened by specially designed annular angle-iron rings inside, to carry the sand load. Burying the tanks not only improves plant appearance, it helps reduce amount of heating necessary to keep the oil fluid. There is also an 8000-gal underground lubricating-oil storage tank close to the plant.

Fuel Oil. We have given considerable study to handling and burning our heavy fuel, which has a pour point of 34 to 42 F. Besides heating the adjacent municipal water filtration plant, and an electric-distribution service building to be erected, steam from waste-heat boilers heats the fuel oil. All fuel piping is insulated and soil-heating cable runs parallel with piping under the insulation. It is used to heat oil in an emergency. Two Sharples centrifuges clean all fuel oil. It also passes through Nugent filters, and is heated and settled in conical-bottom tanks before going to the engines. All lube oil goes through Honan-Crane and Youngstown-Miller earth-type filters.

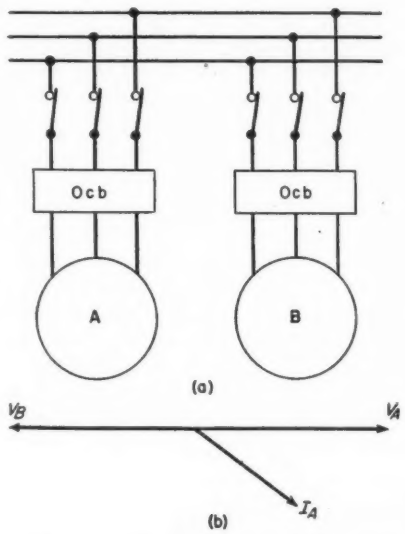
After installing the next unit, as provided for in the building extension, further expansion must be handled by replacing the older 4-cycle engines with large 2-cycle units, as on the plan (preceding page). This would permit increasing total plant horsepower to about 23,400. These older engines are still going strong, however, and what is done will depend on future load conditions and the fuel market.

Grand Haven power system is operated separately from other city activities by a board of five elected local business men serving staggered 5-year terms. Separate accounting gives an accurate record of all operations. The system's own organization handled all engineering and construction of the recent extension.

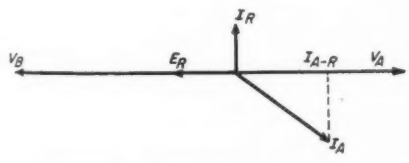
Vector Analysis



1 Angle between voltage and current is decreased as power factor improves



2 Generator B floating on line. Power to prime mover supplies only losses



3 Increasing field of B causes current I_r to flow through both generators

SYNCHRONIZING GENERATORS is first step in parallel operation. Machine voltage has to equal that of bus; also frequency and phase relationship must be the same

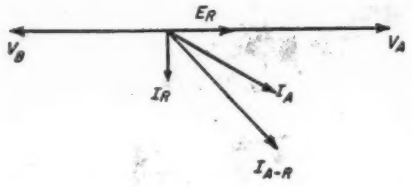
Parallel Operation Of Ac Generators

Here's how machines pick up and distribute load after synchronizing. E J Kelley gives clear analysis of what happens to current and power factor if dc field and power output vary

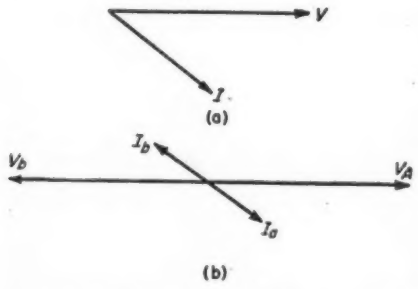
► PARALLEL OPERATION of generators means that two or more units, connected to the same bus, supply power to the load. In parallel operation of dc machines, load division between them is handled by varying field rheostats. Since voltage varies with field strength, machine with highest voltage takes larger load. This is not true in parallel operation of ac generators.

Fundamentals. Let's start our analysis of ac units by considering a single generator connected to the bus and supplying power to load. A 3-phase machine is shown schematically in Fig. 1a, and vectorially in 1b. Since load is generally balanced between the three phases of generators met with in ordinary practice, we will analyze what happens in but one phase. No attempt is made to keep vectors to scale.

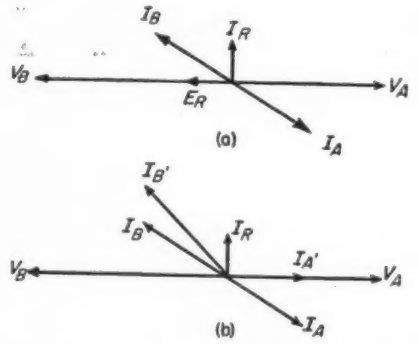
Let's look further at Fig. 1b. The two vectors represent line-to-neutral voltage V, and current in one phase winding, I. Since the majority of industrial loads are inductive, current lags voltage as shown. If load were purely resistive, both vectors would be



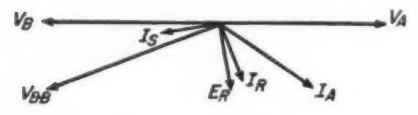
4 Decreasing excitation of B results in power factor change in machine A



5 Considering two generators as series circuit 5b; both are carrying load



6 I_b' and I_a' are resultant currents after excitation of B is increased



7 Effect shown of increasing power to machine B by opening steam throttle

in phase, or in step. Angle at which current lags voltage is indicated by Greek letter θ If the system pf were to improve, as when a synchronous condenser or shunt capacitor is put on the line, angle θ would decrease. Keep in mind, the system pf of a balanced 3-phase system is the cosine of angle θ between phase current and phase voltage. For a Y-connected generator, line current equals phase current while line voltage equals 1.73 x phase voltage. Line voltage is displaced 30 deg from phase voltage.

Assume system load has increased and another machine must be put on line. Second machine, *B*, is started, brought up to speed of *A*, then synchronized to the bus. This means machine and bus voltage are equal; frequency of incoming machine equals that of bus, and phase rotation of both machine and bus are the same.

Varying the Field. After machine *B* is synchronized, the throttle of its prime mover is adjusted so generator is neither taking nor delivering power to line, Fig. 2. By increasing field of *B*, generated voltage increases, hence V_b becomes greater than V_a, Fig. 3. Since V_a and V_b are in opposition (considering two generators as a series circuit), voltage difference E_r sends circulating current I_r through both machines. This current lags behind voltage that produced it and leads voltage of machine *A*.

After excitation of *B* has been changed, current in its winding is I_r while current in machine *A* is vector sum of I_r and I_a. If voltage of generator *B* is decreased, V_a becomes greater than V_b, Fig. 4. Here circulating current I_r is produced by generator *A*.

Keeping these two examples in mind, consider the two machines in parallel, each carrying equal load at same pf. Fig. 5a represents either machine in its vector relation to bus, while Fig. 5b shows relation to the series circuit between machines. Total current to load is sum of the machine currents. Now if field of *B* is strengthened, its voltage increases, Fig 6a. As a result current in generator *B* is vector sum of its original load current *I*b, and circulating current *I*r, Fig. 6b. Although current in generator *B* increased in magnitude, power output remained essentially constant because pf decreased (angle between voltage and current increased). Power output did not vary as:

$$\text{Power} = \sqrt{3} \times V_{\text{line}} \times I_{\text{line}} \times \text{pf}$$

Referring to Fig. 6b, we see resultant current in machine *A* is $I_{a'}$, the vector sum of I_r and I_a. Notice that magnitude of $I_{a'}$ is less than I_a, at same time the angle between current and voltage in machine *A* decreased. Hence when excitation of *B* increases, resultant current and pf angle of that generator increases. Simultaneously magnitude of current in *A* decreased while its pf improved. Total current to load is resultant of $I_{b'}$ and $I_{a'}$, and is the same as before excitation change. Therefore, although total current delivered by machines has not changed, current and pf of each machine has varied. Thus, field adjustment of generators in parallel changes the pf of generators but does not affect load distribution between machines.

Changing Power Input. Fig. 2 shows machine *A* supplying power to load while *B* "floats" on the bus. Here input to *B* is just enough to overcome generator losses. If throttle of *B's* prime mover is opened, rotor spurts ahead and as a result V_b forges to a new position $V_{b\text{-}b}$, Fig. 7. Vector difference between voltages V_a and $V_{b\text{-}b}$ is E_r. This voltage produces a current I_s, the synchronizing current, which lags behind E_r. In machine *B*, the only current flowing is I_s, while current in *A* is the sum of I_a and I_s, which we will call I_r. Notice how addition of synchronizing current I_s has changed total current carried by *A*, and has also changed the phase angle between V_a and I_r. Now we see how increasing power input to *B* decreases power output of *A*.

Motor-Generator Action. In addition, since the angle between $V_{b\text{-}b}$ and I_s is less than 90 deg, *B* is acting as a generator. It is now apparent that by letting more power into prime mover of *B*, load is taken off *A* and put on *B*. As load comes on *B* it produces a resisting torque; which opposes the momentary shift of rotor. Hence *B* spurts ahead only enough to take on load equal to increased input to prime mover. Total current output of both machines is now the same as *A's* alone.

As pointed out, a difference in voltage is produced when either the excitation or power input increases, which causes a current to flow in the series circuit between both machines. This current has been referred to as I_r, current caused by resultant voltage E_r, and as I_s, the synchronizing current. The latter is the more appropriate term since flow of this current tends to hold both machines in synchronism. It does this by motor or generator action, as follows:

Consider Fig. 3 where voltage V_b is greater than V_a. Since both machine windings have practically all reactance and little resistance, current lags nearly 90 deg behind voltage E_r. Power output is therefore positive, signifying generator action in machine *B*. Considering machine *A*, current I_r is over 90 deg out of phase with voltage V_a, representing the input of power, or motor action.

How to Choose the Proper Wire-Rope Construction

Designs for flexibility and strength, and for high resistance to abrasion, corrosion and bending fatigue — here are applications for each type that give satisfactory service. Nonpreformed and preformed rope are compared

By W I LEX
Assistant Chief Engineer
Wire Rope Division
John A Roebling's Sons Co

1 For long wire-rope life, select the correct construction for the application and make sure the sheaves and drums on which ropes run are in good condition

▶ WIRE ROPES, made in many constructions, serve almost countless purposes. For this reason, selecting the most satisfactory and economical rope for a job becomes complicated. One of the first requisites is an understanding of different constructions and why one rope is better suited to a given application.

Construction of a wire rope denotes the number of wires and strands, type of core, and the way these elements are put together to form a rope. There are strand constructions, ranging from 7 wires to 61 or more. These are formed into 6- or 8-strand ropes with either a fiber or a metallic core, Fig. 2 and 3. They can be right or left regular lay, Fig. 4 and 5, and right or left lang lay, Fig. 6 and 7, preformed or nonpreformed. Thus, hundreds of rope constructions are supplied in many grades and sizes. So the manufacturer must literally make thousands of different ropes.

The answer to why so many types are necessary lies in the fact that almost every job differs in some respect from every other. Therefore a rope that performs most satisfactorily in one case may not be best suited in another. The manufacturer's job is to build and supply the type that gives best service for each set of conditions.

Standard Construction. Fig. 8 shows four classifications for commonly used wire ropes: 6x7, 6x19, 8x19 and 6x37 constructions, all of the same diameter. The relative size of the wires, which gives various degrees of flexibility to the different constructions, is shown. The 6x7 construction, a fairly coarse rope, is often referred to as the "coarse-laid" construction.

The 6x19 type is more flexible and thus lends itself to many more applications. It is the most widely used rope in general service. The 8x19 and 6x37 ropes are the most flexible standard constructions because they are fabricated of more and smaller-size wires. But their field of application is somewhat limited because they lack resistance to abrasion and corrosion characteristic of the 6x19 type.

Fig. 8 shows the difference between these standard constructions and the way the various names have been derived. The first number refers to the number of strands whereas the second gives the number of wires in each strand. For instance, 6x7 rope has six

strands, each made with seven wires.

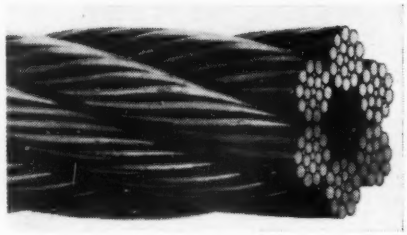
There are many other constructions of wire rope besides the ones shown, also several different constructions that fall under each of the standard classifications. For example, 6-strand ropes with 16 to 25 wires in each strand fall under the 6x19 classification. Three such ropes are shown on the bottom row, Fig. 8. The first one actually has 19 wires per strand while the other two have 21 and 25 wires respectively. Likewise, 6-strand ropes with 26 to 46 wires in each strand fall under the 6x37 classification, but only one of these is shown. Each construction is suited to a particular field, and for best economy by using the correct construction for a given job.

Fabricated of a few relatively large-diameter wires, the 6x7 rope has better resistance to corrosion than the more flexible ones. It is suitable for services where abrasion is severe but where bending is a minor consideration, as on some slopes and mine haulages, for traction ropes on tramways and for guys where corrosion may present a serious problem.

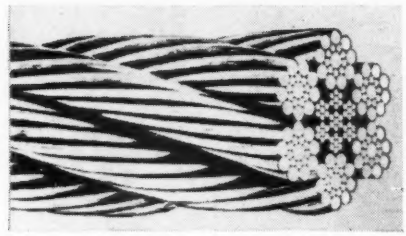
In 6x19 ropes, wires are of a size that have about equal resistance to abrasion and bending fatigue. The coarser 6x19 ropes are used on inclines and on scrapers and draglines where they are subject to considerable scrubbing along the ground, and for oil-well drilling. The intermediate 6x19 constructions serve for freight and passenger elevators, on mine-shaft hoists, on car dumpers and skip hoist. The more flexible are for general hoisting purposes, as on derricks, cranes and shovels.

Freight, Passenger Elevators. Because of its greater number of strands of slightly smaller diameter, 8x19 rope is more flexible than 6x19. But it has less metallic area and a slightly larger center core, and so does not have the strength and resistance to crushing and distortion that a 6x19 has. For these reasons the 8x19 constructions have fewer applications in industry, outside of some skip hoists and overhead traveling cranes. It is used extensively on freight and passenger elevators where its greater flexibility is an advantage under the fairly easy operating conditions.

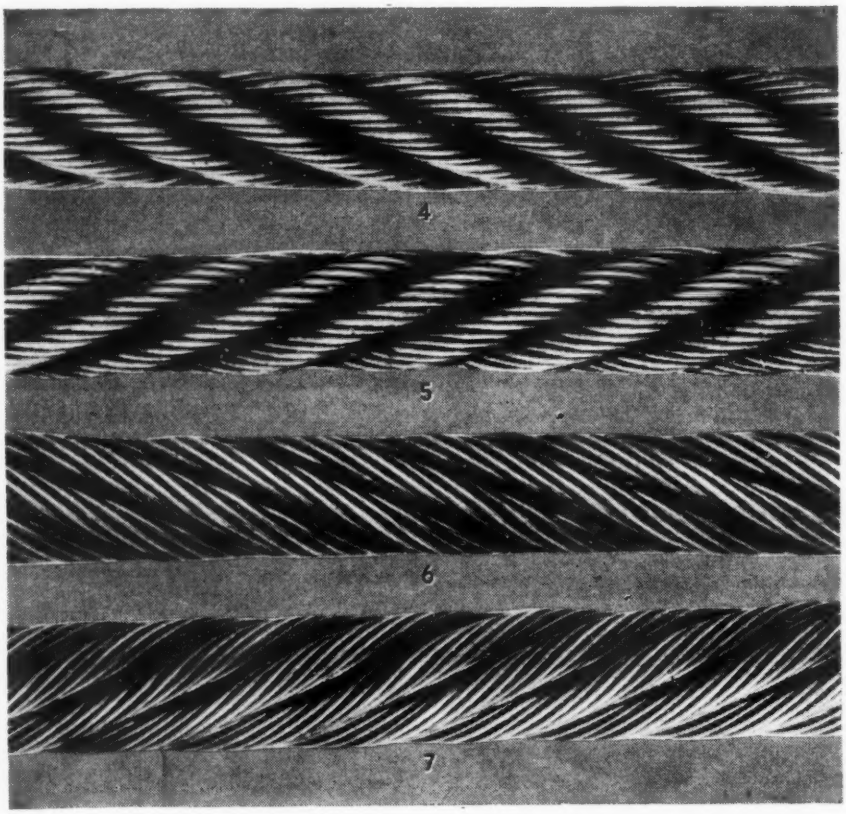
Of the 6-strand ropes the 6x37 is the most flexibile, and so is adapted to small sheaves and drums, and where abrasion and corrosion are a minor factor. Therefore it is not often used outdoors unless rope size is fairly large. It is almost universally selected for overhead traveling cranes and, in the larger sizes, for dredges, stripping shovels and draglines in coal fields.



2 Wire rope may have 6 or 8 strands around a fiber core as in this 6x21



3 A wire-rope core increases rope's crushing resistance and strength

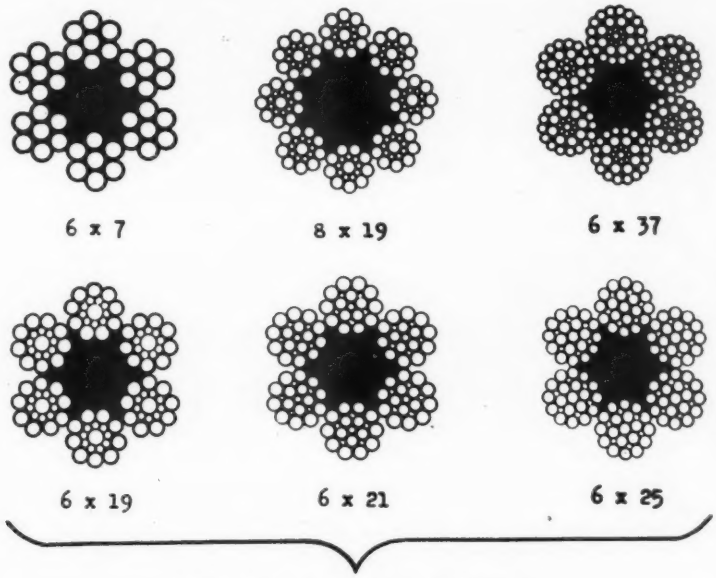


4-7 These four different rope lays are in common use: 4, regular lay, right lay; 5, regular lay, left lay; 6, lang lay, right lay; 7, lang lay, left lay

The 6x7, 6x19 and 6x37 ropes are often fabricated in the lang-lay construction. In the regular lay, Fig. 4 and 5, the wires are laid opposite to the direction the strands lie in the rope. As a result, individual wires on the rope's outside are nearly parallel to its axis. In the lang lay construction, Fig. 6 and 7, wires and strands lie in the same direction, which gives the wires a considerable angle with the rope's axis. Lang-lay rope has the same strength as regular lay but has the advantage of being slightly more flexible for the same size and strand construction. Also, lang-lay has greater resistance to abrasion than regular-lay. It is used for hoist and dragline ropes on excavating equipment, scraper wagons, carryalls, and other similar equipment.

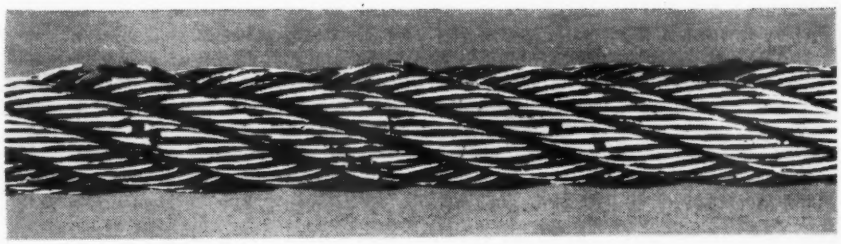
Independent Wire-Rope Cores. Any of the standard constructions are supplied with either a fiber or an independent wire-rope core. The all-metallic construction, however, is generally used in 6-strand ropes because conditions requiring its use can seldom be met satisfactorily with the 8x19 constructions. An independent wire-rope core adds about 7.5% to the rope's strength and reduces its stretch. On some applications increased strength and low stretch may justify using this class of rope but usually it serves where a firmer support for the strands is desirable.

Deteriorated Fiber Core. It is advantageous to use rope with an independent wire-rope core where temperatures are high enough to char or burn a fiber core. The rope core in Fig. 9 has deteriorated in this manner and its cross

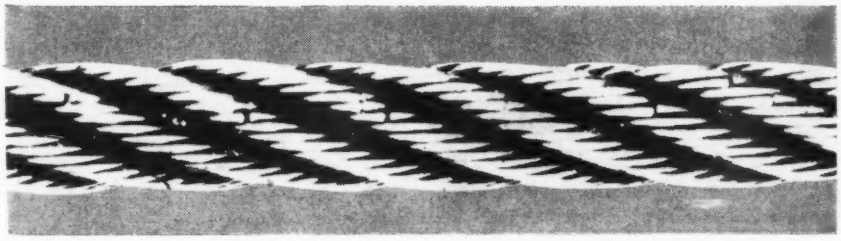


8 Here are the four classifications into which the commonly used wire ropes can be grouped: they are 6x7, 6x19, 8x19 and 6x37 constructions. All are shown of the same size to indicate the relative size of the wires which give various degrees of flexibility to the different constructions

9 This cross section shows that the fiber core has deteriorated because of the high temperature and thus has permitted the strands to bite into each other



10 When the wires in a nonpreformed wire rope break, their ends generally rise above the surface of the strand so that their locations are easily detected



11 Broken-wire ends in preformed rope generally remain closely in place in the strands but with some care these breaks are easily seen during inspections

section clearly shows how its diameter was reduced and how the core allowed the strands to pull toward the center and toward each other (overlap). But since overlapping could not occur, destructive nicking developed at the points of strand contact. This has reduced the rope's strength and its useful life.

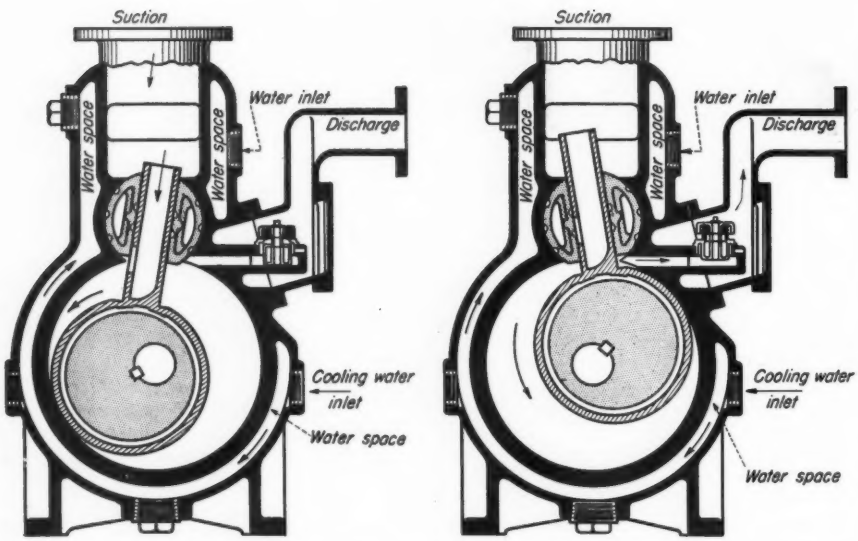
The same action occurs if a rope with fiber core is used where the pressures are high enough to cause the strands to crush the core. High pressures occur with heavy loads and where the rope operates over sheaves and drums of relatively small diameter. These conditions prevail on most shovels, cranes and draglines, and so on excavating equipment, ropes generally have an independent wire-rope core. These applications form one of the largest uses for this type of rope.

Preformed Constructions. Because a preformed wire rope is made of the same material as the standard or non-preformed, it can be supplied in any size, grade and construction, and in either regular or lang lay. It is made in the same way as non-preformed rope, except that during the final operation the wires and strands are formed to the spiral shapes they assume in the finished rope. Because of this difference the strands do not have a tendency to unlay when the rope is cut. This inert characteristic makes a preformed rope readily distinguishable from a standard or nonpreformed type.

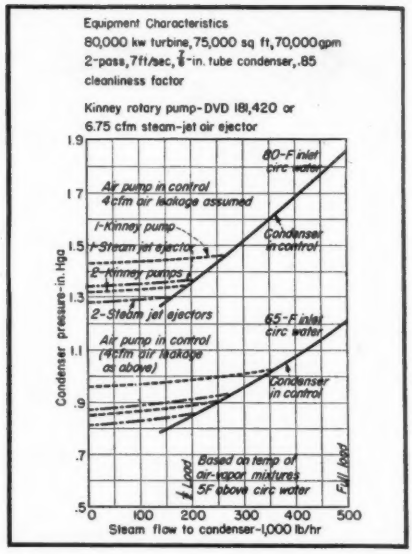
This characteristic also makes preformed rope less susceptible to some forms of abuse and less likely to be damaged during installation. Because preformed rope is a little more flexible than nonpreformed of the same size and construction, it gives better service where bending and fatiguing conditions are severe.

Broken Wires. Another difference between the two types is that broken wires are not so easily detected in the preformed construction as in nonpreformed. Because the strands and wires are shaped to their spiral forms, ends of broken wires remain in their original positions and do not spring up from the surface as on nonpreformed ropes.

Fig. 10 shows how broken wires generally appear in a nonpreformed rope. The difference between these and the breaks in preformed rope is apparent, Fig. 11. Therefore it is generally a little more difficult to inspect a preformed rope for broken wires, but if proper care is taken these breaks can be seen easily.



1 Rotary pump has eccentric rotor that creates space for gas entering suction at top while compressing previous charge to discharge pressure and forcing it out



2 At low condenser-steam flows the air pump capacity determines the vacuum

Rotary or Steam-Jet Air Pumps?

Here's a comparison of cost and operation of two types of surface-condenser air-removal equipment, made by W C Woodman, mechanical engineer, Stone & Webster Engineering Corp

▶ DURING THE PAST YEAR several large surface condensers have been installed with rotary-type vacuum pumps instead of steam-jet air ejectors. The decision on the proper vacuum pump is best made after comparing the merits of the two types. Here we report certain items to consider in preparing such a survey, and discuss the calculation of air-pump capacity.

For a number of years, ever since it supplanted reciprocating and hydraulic-type vacuum pumps, the steam-jet air ejector has been standard equipment for surface condensers.

Compared with a mechanical rotary pump the steam-jet air ejector has the following advantages: (1) lower first cost (2) no moving parts (3) greater air-removal capacity. Several factors, however, favor the rotary air pump and become increasingly important with the trend to higher operating pressures and temperatures. These are: (1) Ammonia contamination, believed to be introduced by returning air-ejector drains to the system, is a problem in some plants. (2) Steam jets normally operate at reduced pressure and sometimes excessive maintenance of reducing devices is encountered.

The rotary pump performs both the operations of normal air removal and of pumping down the unit when starting up. Large capacity "hogging jets" must supplement air ejectors to start up large condensers in a reasonably short time. This duplication of jets, however, is not a serious operating disadvantage.

Rotary Pump. One type of rotary vacuum pump* is shown in Fig. 1. An eccentric rotor displaces air and vapor ahead of it, drawing these gases into a suction port and discharging through the outlet. No sliding vane or metal-to-metal contact exists between rotor and casing. A viscous fluid maintains the seal, tri-cresyl phosphate being employed for condenser-vacuum-pump service. The air-vapor mixture together with some of the sealing fluid discharges through a baffled tank in which the sealing fluid separates out and returns to the pump. In condenser-vacuum-pump service an additional whirl-type separating chamber completes the separation of air and moisture. This pump type has served for some years in evacuating electric light bulbs and in hydrogen-cooled generator-seal oil-conditioning systems. During the war they served as "roughing pumps" in certain high-vacuum processes. These pumps can reduce pressures below 0.001 in. Hg abs, well beyond power-plant requirements.

The largest available size of this pump has been customarily applied to surface condensers. This unit has a pumping capacity of about 700 cfm at atmospheric pressure and about 550 cfm at 29 in. Hg vacuum. A 40-hp motor is usually provided with this size. although continuous operation needs at 29-in. Hg vacuum are generally less than 25 hp. Maximum power demand occurs at about 22 in. Hg vacuum.

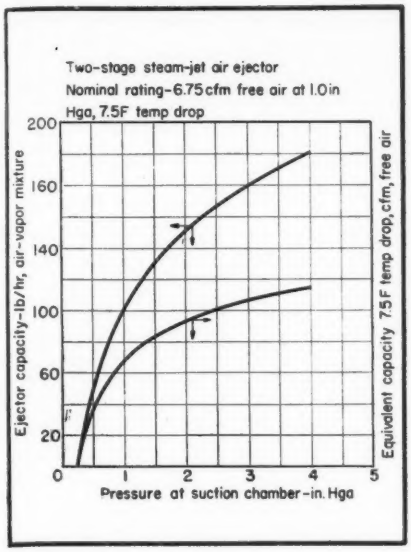
*Rotary-pump characteristics in this article are based on the type DVD—181,420 rotary-vacuum pump, as made by the Kinney Mfg Co.

COMPARISON OF AIR PUMPS

In selecting the proper type of air pump, the following factors require comparison and study:

First Cost. In an installation of any appreciable size and importance two rotary pumps should be used for reliability. Normally one pump in operation should be sufficient, with the second held in standby reserve.

Condenser manufacturers often fur-



3 Typical 2-stage steam-jet air ejector performance at various suctions

nish a twin-element 2-stage air ejector with each element having enough capacity to handle normal air leakage. But these twin elements are mounted on a single inter- and after-condenser. To insure continuous service and provide the same degree of reliability as with two rotary pumps, the specifications given the condenser manufacturer should require furnishing of two banks of inter- and after-condensers, each with its own 2-stage steam jet. These ejector units should be piped in parallel in the condensate line, and each should have capacity to handle maximum expected normal air leakage. It is also necessary to furnish a high-capacity auxiliary hogging jet for starting.

Here's the first cost comparison:

Two rotary vacuum pumps complete with motor drives, baseplates and individual separators, but with common whirl chamber, capacity of each equivalent to 4-cfm free air leakage at 1.0 in. Hg abs and 7.5-F temperature depression— $11,500

Two single-element 2-stage steam-jet air ejectors, each with its own inter- and after-condenser, capacity of each, 101.25-lb air-vapor mixture, equivalent to 6.75-cfm free air leakage at 1.0 in. Hg abs and 7.5-F temperature depression and one hogging jet— $6700

The reason for choosing a 6.75-cfm air ejector is explained later. Ejector prices are proportional to capacity and if a 4-cfm unit were selected, it would have a lower first cost. These air-ejector prices assume purchase as part of condenser since prices of auxiliaries are higher when bought separately.

Installation Costs. It is necessary to compare piping and electric-power service costs. Piping installation is less extensive for the rotary pump, but cost of electric-power supply must be added. Installation of steam and mechanical types often cost about the same.

Capability. One of the most important items to consider is the pump capacity to remove from the condenser an air-vapor mixture resulting from free air leakage into turbine and condenser. Capability of the two equipment types differs considerably. It depends on a variety of conditions, including vacuum, temperature of air-vapor mixture at air offtake, air-leakage rate and the volumetric pumping rate of the air-removal equipment.

Given two examples of air pumps and assuming one has a capacity just equal to inward rate of air leakage, this pump would maintain a vacuum equal to that which the condenser can produce. If the second unit had a smaller capability, the condenser vacuum would fall off until, under the increased absolute pressure, the specific volume of the air-vapor mixture would bring the pump capability at the decreased vacuum in equilibrium with the inward air-leakage rate.

Air-removal equipment must have the capacity to deal with the maximum expected air leakage at the vacuum the condenser must maintain. Capability under varying conditions will be discussed later.

Starting Capacity. Characteristics of the rotary vacuum pump, Fig. 3, enable it to remove large quantities of air when starting up and to pump down the turbine casing and condenser shell to a partial vacuum, as well as to operate under running conditions. Initial pump-down time can be shortened by running both rotary pumps in parallel during the starting-up period, and later shutting down one and allowing the remaining pump to handle normal continuous leakage.

Steam-jet air ejectors have insufficient capacity for initial pump-down and must be supplemented by an auxiliary high-capacity hogging jet. No great difference in pump-down time results from the two methods, and either type of apparatus should be able to reduce condenser pressure to 10-in. Hg abs within 15 minutes.

Ammonia Contamination. The plant designer must judge whether ammonia contamination is likely to be present. This has been a serious problem in some plants, attributable to contaminating the air-ejector condensate with ammonia and its return to the system. This sometimes occurs when makeup water is taken from a river or other source contaminated with sewage, or it may be caused by circulating-water leakage in the condenser.

Ammonia vapor is least soluble under condenser pressure and temperature conditions, so that the air-vapor mixture withdrawn by the air pump contains some free ammonia vapor. A rotary pump will permanently remove this vapor by discharging it to the atmosphere. In a steam-jet air ejector the ammonia will recondense and redissolve in the air-ejector drains and return to the plant cycle. Some plants are now wasting air-ejector condensate rather than risk recontamination.

Maintenance. Present-day air-ejector installations usually require reducing steam to 200-300 psig at the jets. Maintenance on high-pressure reducing valves has been excessive and some have been undesirably noisy. Recently there has been a tendency to omit the automatic pressure reducing valve and substitute a plain manually operated valve of the ported type. After adjusting the valve by means of a pressure gage on the downstream side the valve is locked in position.

Rotary pumps will necessarily, in time, involve some maintenance, even where contact of internal parts has been eliminated.

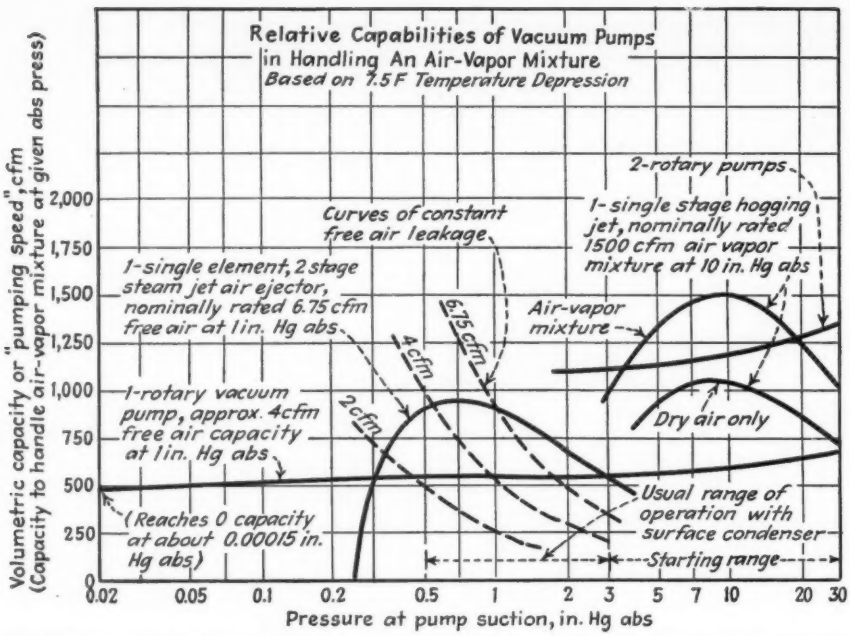
Operating Costs. Comparative figures, based on coal at $7.50 per ton, 13,750 Btu per lb and 7000-hr-per-year operation, indicate nearly equal operating costs for the equipment sizes selected. Steam consumption of an air ejector is very nearly proportional to its nominal rating and if an ejector with a smaller air-handling capacity were selected the annual operating cost would be proportionally less.

Operating cost of a single 2-stage 6.75-cfm air ejector that is using 405-lb-per-hr of steam, with correction for the condensate heating effect in the air-ejector condenser— $550 per yr

Operating cost of a rotary pump that is using 25 hp— $500 per yr

Part-Load Operation. At low loads the air-removal equipment, rather than the condenser, controls the vacuum. Higher-capacity air pumps will produce a slight improvement in vacuum. If light-load performance is important, the improvement in economy will have some effect on the selection of air-removal apparatus.

Theoretically a demand charge should be assessed against the air ejector for the boiler-plant capacity required and against the rotary pump for the boiler and generating capacity.



4 Relative capabilities of vacuum pumps depend on type and individual characteristics; the rotary-pump capacity remains relatively constant at all pressures

In view of the small steam and power requirements this has been disregarded.

Making Decision. An ammonia contamination problem may dictate selection of the rotary pump. Since an air ejector can readily furnish greater air-removal capacity than a rotary pump this may lead to its selection in other cases. Use of a rotary pump necessitates keeping air leakage within limits of best practice to avoid loss in vacuum. At lower loads, where air pumps rather than the condenser control vacuum, the air ejector may produce an average of 0.1 in. Hg better vacuum.

Combination Unit. An interesting arrangement, in which both high vacuum capability under normal operation and high pumping capacity when starting are combined in one set of equipment, occurs in the primary steam jet—secondary reciprocating vacuum pump unit. This has been in successful operation in one modern station for a number of years. The secondary pumping unit that operates down to about 4-in. Hg abs is used to evacuate the condenser when starting, and then continues to run as the second stage of a steam jet, which operates at about 1 in. Hg abs. The primary jet can be operated with low-pressure extraction steam, thereby improving the economy of this combination unit.

AIR-REMOVAL CAPABILITY

Generally speaking, the air-removal capability of a rotary vacuum pump decreases with (1) higher vacuums, (2) a decrease in temperature depression (below the temperature corresponding to the condenser vacuum) of the air-vapor mixture as it passes over the air-cooler tubes, and with increased air leakage.

Air leakage in a tight surface condenser, with the turbine glands in good condition, should not normally exceed 3 to 4 cfm. Some condensers perform consistently with only 1.5- to 2-cfm leakage. Others may run as high as 5 to 6 cfm, but greater leakage is unusual with a condenser in good condition.

Condenser manufacturers base their air ejectors on the requirements of the Heat Exchange Institute. The following representative figures are from the Condenser Section of its Standards:

Maximum Steam Condensed, lb per hr	*Free Air Leakage cfm at 70 F*
100,001-150,000	6.5
150,001-250,000	8.5
250,001-350,000	10.0
350,001-450,000	11.5
450,001-600,000	13.5
600,001 and up	16.0

As applied to large surface condensers, this table would bear revision, since it requires designing for much higher air-leakage rates than are normally experienced.

As an example, if an 80,000-kw turbine is selected for which the full-load condenser flow is 495,000 lb per hr, the air leakage for which air ejectors are supplied under the above regulation is 13.5 cfm. This requirement is excessive. But furnishing two 2-stage steam jets, each rated 6.75 cfm and operating only one under normal conditions, would be a reasonable interpretation of the Heat Exchange Institute requirements. Unless otherwise requested, a condenser manufacturer may furnish double this capacity. If this is supplied in two jets, the previously mentioned annual operating costs would be doubled.

When operating in conjunction with a surface condenser a vacuum pump handles an air-water vapor mixture that has been subcooled several degrees below the saturation temperature by passing over the tubes in the air-cooler section of the condenser. Under Dalton's law of partial pressures, each component of this mixture (air and water vapor) occupies the same total volume as that of the entire mixture, but each component is present at its own partial pressure. Sum of the two partial pressures makes up the total pressure at the air offtake. This partial pressure of the air at condenser-air off-take has a profound effect on capacity of air-removal apparatus.

In all computations involving partial pressures, temperature depression of the air-vapor mixture below the saturation temperature of the vapor must be either measured or assumed. (If saturation temperature were used, the mixture would be 100% vapor.) The Heat Exchange Institute specifies a 7.5-F temperature depression. This is conservative, and good condensers should do better. Another criterion being considered in the industry assumes the air-vapor offtake at definite elevation in temperature above that of the inlet circulating water. A figure of 5 F has been mentioned, but it requires a good air-cooling section to accomplish this. Such an assumption implies a greater subcooling of the air-vapor mixture at high loads than 7.5 F below saturation temperature, this being more favorable to either type of air removal equipment.

Under the pressure and temperature conditions in a condenser, both air and water vapor obey the perfect gas law and Dalton's law with sufficient accuracy. Thus for a given weight of air at constant temperature

$$V_2 = V_1 \frac{P}{P_a} \quad (1)$$

where

V_2 = air volume under reduced pressure
V_1 = free air volume, or "air leakage"
P = atmospheric pressure, or 30 in. Hg abs
P_a = partial pressure of the air at air offtake, in. Hg abs

For example, if the volumetric capacity or pumping speed of a rotary pump is 550 cfm at 29-in.-Hg vacuum, (from Fig. 4) what corresponding rate of leakage of free atmospheric air can it handle and still maintain this vacuum? Assume 7.5-F temperature depression of the air-vapor mixture.

Condenser pressure, in. Hg abs	1.0
Saturation temperature, F	79.0
Temperature depression, F	7.5
Temperature at air offtake, F	71.5
Partial pressure of vapor at 71.5 F, in. Hg abs	0.78
Partial pressure of air, in. Hg abs	0.22

From equation (1) and neglecting effect of temperature change on volume:

$$550 \times \frac{0.22}{30} = 4.0 \text{ cfm}$$

Thus a rotary pump can handle an air-leakage rate of 4 cfm of free atmospheric air and maintain a vacuum of 29 in. Hg.

Since the action of a steam-jet air ejector is based on the transformation of the jet kinetic energy into pressure energy of the air-vapor mixture in the diffuser, such jets are always rated in terms of their weight-rate capacity to handle an air-vapor mixture. A representative "6.75-cfm" jet with capacity in lb-per-hr plotted against vacuum is shown on the left-hand curve of Fig. 3. If the temperature depression of the air-vapor mixture as it enters the jet suction is known or assumed, the capacity of the jet in equivalent volume of free air may be determined as shown in the right-hand curve of Fig. 3. For this transformation use the following:

$$(2) \qquad W_m = W_a + \frac{0.62 W_a P_v}{P_a}$$

where

W_m = total weight of air-vapor mixture, lb
W_a = weight of air in the air-vapor mixture, lb
P_v = partial pressure of vapor
P_a = partial pressure of air

Fig. 4 shows the volumetric capacity of both types of pumps in terms of their capabilities under actual vacuum conditions rather than in terms of free-air handling ability. The rotary pump exhibits an almost constant, although restricted, volumetric capacity through the usual operating range of vacuum in surface condensers, extending from atmospheric pressure into a range of low absolute pressures never realized in power-plant practice. The 2-stage steam-jet air ejector, on the other hand, exhibits its characteristics of high capacity over a more limited range of pressure with rapid reduction in capacity when passing into pressure regions, both above and below the operating range.

Table I shows the effect of vacuum variation on air-pump performance, and Table II the effect of variation in temperature at the condenser air offtake. These tables were calculated using equation (1) and show the effect of 4-cfm and 6.75-cfm free air leakage.

The volume of the air-vapor mixture to be handled should be compared with the capacities of the two types of air pumps. The two pumps in Fig. 4, although of different capabilities, have been compared because the rotary pump is, to the author's knowledge, the largest made at present and the one usually used for this service. The "6.75-cfm" air ejector could be supplied for this condenser, although it is larger than the rotary pump, but it is smaller than those often furnished in the past.

Fig. 4 includes curves of constant free air leakage. Intersections of these curves with the characteristic of either vacuum pump indicates the limiting vacuum obtainable. The figure also indicates the "starting range" of pump suction pressure and the comparative performance of a large hogging jet, rated 1350 lb per hr or 1500-cfm air-vapor mixture at 10 in. Hg abs with one and two rotary pumps. Note that these performances are comparative only; air ejectors and hogging jets are available both larger and smaller in capacity, at prices and with operating costs in proportion.

The higher the vacuum and the lower the temperature depression at the air offtake, the less favorable are conditions for either type of air pump. Under the assumed air leakage, when the volume to be handled exceeds the air-pump capacity at a given vacuum (assuming the condenser capable of producing that vacuum) the air-removal equipment will be unable to hold the vacuum and it will fall off until the smaller air-vapor specific volume comes into equilibrium with the air-pump capability. If desired, air-removal capacity can be doubled by operating two units. Remember that some of the more extreme conditions in the tables and those in which the air pump capacity is apparently exceeded may be beyond the reach of the condenser or uneconomical to attain. Large turbines, unless designed for unusually high vacuum, reach a point where an increase in vacuum produces very little additional power output with constant throttle flow.

Fig. 2 demonstrates the relative abilities of the condenser and its air pumps to "control" the vacuum over the load range, using an 80,000-kw steam turbine and a 75,000-sq-ft 70,000-gpm condenser unit as an example. In this case, the temperature of the air-vapor mixture has been taken 5 F above that of the circulating-water inlet, instead of 7.5 F below saturation temperature.

Solid lines show the condenser characteristic at 65- and 80-F inlet circulating-water temperatures corresponding to average and summer conditions. Dashed and dotted lines show air-pump performance with 4-cfm free air leakage for the various pump combinations designated. For the assumed rate of air leakage, at all points to the right of the intersection of the two sets of curves, the air pump can handle the air leakage, and has no effect on condenser performance. In other words,

(*Continued on page* 146)

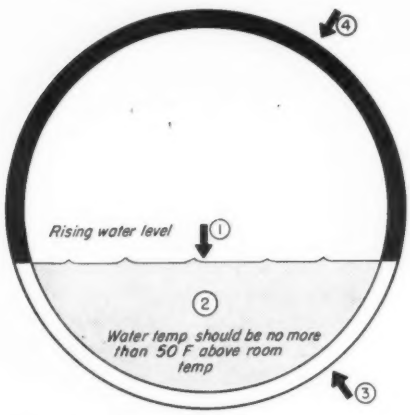
Table I—Effect of Vacuum on Air-Vapor Mixture Volume

Condenser vacuum, in. Hg	27.0	28.0	29.0	29.5
Condenser pressure, in. Hg abs	3.0	2.0	1.0	0.5
Volume of air-vapor mixture, cfm, to be handled with:				
4-cfm free air leakage	205	285	550	1000
6.75-cfm free air leakage	340	480	920	1700

Table II—Effect of Vacuum and Temperature on Air-Vapor Mixture Volume

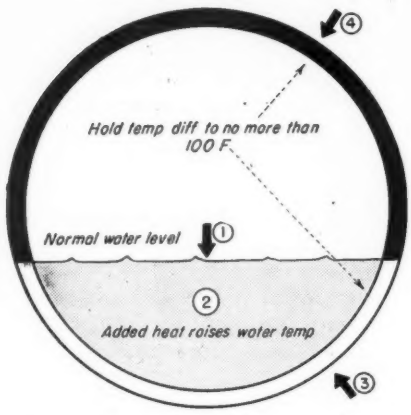
Temperature depression of air-vapor mixture below saturation temperature, F	5	7.5	10
Volume of air-vapor mixture, cfm, to be handled with 6.75-cfm free air leakage for condenser pressures of:			
1 in. Hg abs	1350	920	700
2 in. Hg abs	700	480	380

1: Filling a Boiler

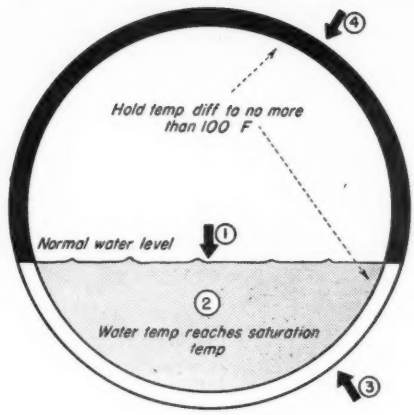


1 Level of the water is rising
2 Incoming water at a temperature higher than drum temp can develop thermal stress
3 Underwater-drum temperature — outside surface is at room temperature; inside surface is at water temperature
4 Overwater-drum temperature stays at temperature of the room

2: Raising Boiler-Water Temperature



1 Level of the water is normal
2 Water temperature increases with added heat
3 Underwater-drum temperature parallels water-temperature rise up to 212 F, atmospheric pressure
4 Overwater-drum temperature experiences little rise until steam forms



1 Level of the water is normal
2 Water temperature rises to saturation temperature at working pressure
3 Underwater-drum temperature follows the water temperature as the pressure rises
4 Overwater-drum temperature rises sharply up to steam temperature. This occurs when the water reaches 212 degrees F

Save Stress on Boiler Drums

Temperature differences in normal service set up stress in high-pressure thick-drum boilers. Correct operation controls it, says F X Gilg, application engineer, Babcock & Wilcox

▶ THE HIGH RELIABILITY of today's boilers makes us forgetful of the forces involved. A sudden release of energy stored up in boilers or pressure vessels, under pressure and temperature, lets loose a tremendous force. Control of what could be a damaging power comes about by (1) use of proper auxiliary equipment (2) exercise of a good operating procedure.

That procedure should involve a careful, periodic inspection program to detect deterioration of metal surface from corrosion, erosion, overheating or overpressure. It should reach into areas difficult to get at—for instance, buried heads of drums and blowoff connections where undetected corrosion could proceed with disastrous results.

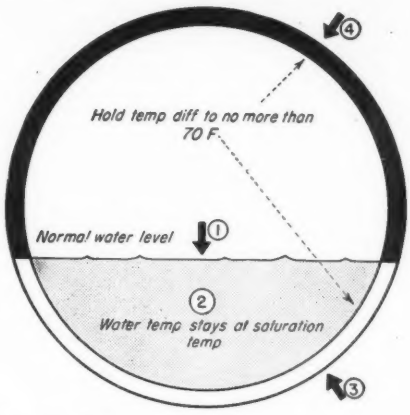
But what about some positive means of controlling, reducing or preventing explosion of pressure parts? Auxiliary equipment fills this function. Every boiler or pressure vessel should be equipped with safety valves. They protect against overpressure. But their value becomes questionable if they (1) fail to open at the proper pressure (2) provide inadequate venting capacity. This capacity as set by the ASME Code permits the discharge of all steam a boiler can generate without a pressure rise of over 6% above maximum allowable pressure.

While still on the subject of positive means to control and prevent explosions of pressure vessels a word on personnel applies. An operating organization should have within its setup provision for keeping alert and fully conscious of the safety of all its equipment. A single yearly inspection by covering insurance companies alone cannot suffice. Observations and reports of operating personnel who live with and maintain equipment should serve to supplement outside reports—and, even more important, to affix responsibility for equipment soundness. Under this arrangement, fundamentals of safe operation are being met.

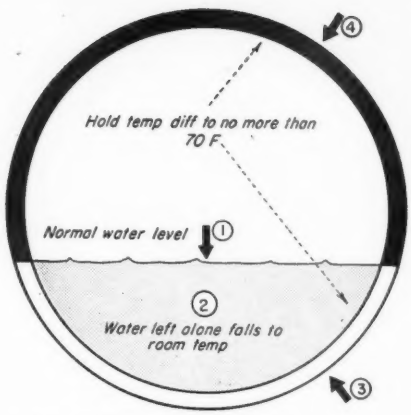
Overheating Precautions. Any change in furnace conditions—additions of watercooled walls, a different coal of higher grindability, a change to oil or gas, or some other modification that tends to increase steaming capacity—requires additional safety-valve capacity for proper protection against overpressure. In addition pump capacity should be ample to supply the added water needs, or overheating troubles may occur.

Overheating, another cause of metal weakening, develops in modern boilers from an inadequate water supply through the waterwalls. Maintaining a proper water level is of prime importance. Water columns, gage glasses, and other water-level indicating and recording equipment serve as safeguards against overheating. They must be kept in perfect condition. Actual water level should be checked every so often by the old-fashioned method of removing manhole covers to be sure that indicated

3: Shutting Down a Boiler



1 Level of the water is normal
2 Water temperature is at saturation temperature for drum pressure
3 Underwater-drum temperature — metal follows water temperature
4 Overwater-drum temperature—metal cools slowly from radiation; heat-flow from metal passes into superheat



1 Level of the water is normal
2 Water temperature falls from 212 F eventually to room temperature
3 Underwater-drum temperature — metal follows water temperature
4 Overwater-drum temperature—metal holds much higher temperature than metal that is below water

By Planned Operation

water level as the auxiliaries show it is correct.

Auxiliaries have to be checked regularly. Water-column lines should be straight and direct to the drum to eliminate any pockets that may give false readings. Feedwater regulators require close supervision.

Blowing down a boiler through regular blowoff valves should be done with the water level constantly in sight. This may require a second man to watch the level and signal the operator at the valves if they are so located that the water level can't be seen.

Operator Protection. Some foolproof way should be provided to guard against scalding a man in the drum of an idle boiler by steam. It may escape through a leaky or partly opened blowoff valve connected to a common blowoff line into which an adjacent boiler is being blown down.

Still another possible source of overheating trouble can come from upsetting circulation in the waterwalls. Because of this danger most authorities recommend against blowing down waterwalls except at very low ratings. In those cases where high concentrations require blowdown of waterwall headers at high ratings small lines for continuous blowdown reduce any tendency to upset circulation and develop overheating.

Temperature Stresses. With the advent of higher operating pressures, boiler-drum designs require plate thickness in excess of 4 in. Twin Branch, 2400 psi, for example, has a steam drum that has 54 in. ID and is $8\frac{7}{16}$ in. thick. Temperature stress in such drums is considerable during heating or pressure-raising periods and cooling or pressure-reducing periods.

Studies were set up on drums of over 4-in. thickness to develop operating instructions to control temperature difference between inside and outside fibers of the top and bottom of a drum. Data from these studies help avoid stresses that could develop incipient cracks in the drum metal. All the normal conditions that a boiler drum experiences contributed data to these studies.

From the very beginning—filling a boiler with water at a temperature higher than that of the drum, Fig. 1—the inside fibers of the drum receive a compressive thermal stress that varies with the difference in the temperature.

Once filled to the normal-water level with a fire set under it, the drum undergoes still other temperature stresses. Water temperature within the drum increases at atmospheric pressure up to 212 F. The metal in that portion of the drum below the water level increases in temperature at a rate that parallels the temperature increase in the water. The rest of the drum increases in temperature only slightly, Fig. 2. When steam forms at 212 F the upper region of the drum undergoes a sharp increase in metal temperature up to 212 F. This heating rate is beyond the operator's control. For this reason any regulation over the large temperature difference between top and bottom of the drum or the steep temperature gradients through the drum shell must come from other than operating measures.

But to complete the pressure-raising cycle to final line pressure from steam at 212 F and atmospheric pressure: Temperature difference between top and bottom portions of the drum amounts to little during this pressure rise. It may, however, involve a serious gradient through the shell if rate of heating or pressure rise is too rapid.

Shutdown Experience. During a regular shutdown, with normal water level in the drum, reduction in steam pressure causes a reduction in water pressure, and rate of temperature reduction of the drum portion below the water level follows that of the boiler water, which is at saturation temperature.

But as pressure falls, steam in the upper part of the drum becomes superheated so its temperature has no direct relation to saturation temperature. This upper part undergoes cooling from (1) radiation through drum installation (2) heat flow around the shell (3) small quantity of heat that passes into the steam to superheat it to drum temperature. Reduction in temperature of the upper portion of the drum lags behind that in the bottom unless some steps outside the normal process can be taken.

When drum pressure drops to atmospheric and bottom of drum is at 212 F the upper part can still be as much as 150 deg or more above this point.

Many plants give a boiler unit a hydrostatic test before draining, and subject the upper portion of the drum to a sudden shock from the test water. A second, and even more severe cold-water shock comes from hosing down the drum so the maintenance crew can enter soon after the pressure is off.

Operation. Severe thermal stresses in

I: Recommended Procedure for Forced Shutdown

Pulverized coal, oil, gas

1. Shut off the fire immediately
2. Shut down the forced draft
3. Close off the steam output
4. Stop the flow of feedwater to boiler
5. Reduce air flow as low as possible to a point consistent with safety from water or steam blowing into boiler room

Stoker firing

1. Shut down the fuel feed
2. Cut off the combustion-air supply
3. In extreme emergency, smother fire. Take care not to cause gas explosion
4. Close off the steam output
5. Keep the feedwater flowing to maintain the water level

II: Procedure for Feed Loss

Stoker firing

1. Cut fires when the water level drops out of sight
2. Close all blowdown and drain valves to conserve H_2O
3. Reduce load on steam turbines, etc
4. Trip out turbine if the boiler pressure falls below 20% of normal

a boiler on the line from purely operating causes are (1) sudden cooling following the loss of a boiler tube (2) a large pressure drop produced by extinguishing the fires without immediately shutting off steam outlet to the plant load.

Thermal stress from chemical feed connections or cold-water inlets to the drum are problems of design that require thermal sleeves for their correction.

Operating Precaution. Now that we know just how temperature stress can develop in a boiler drum we appreciate the value of an operating procedure that will prevent any stress from developing. Briefly, abnormal stress does not develop if temperature differences between various sections of the drum are limited to (1) 100 F during pressure-raising (2) 70 F during pressure-reducing. These limits apply to drums of any thickness. In filling a boiler hold feedwater to 50 F above or below drum temperature to reduce chances of tube seat leakage.

Temperature difference can be measured by thermocouples, preferably spotted as follows: (1) on the thickest part of the drum, top and bottom (2) about 18 in. from the top on the drum circumference (3) on a boiler tube or circulating tube that is always at saturation temperature. An approximate check method for drums up to 10 in. thick is to hold the rate of increase of saturation temperature to 100 F per hr so the drum parts will remain well within the temperature-difference limitation. For drums up to 4-in. thickness the restrictions on heating rates imposed by superheaters and other boiler elements hold drum temperature differentials within the recommended limits. Similarly on shutdown, unless it is accelerated by blowing down and feeding water, normal cooling rates at natural pressure drops lie well within the 70-F-per-hr limit. For a thick-drum high-pressure installation, where steam can discharge into a lower-pressure system, allow the pressure to drop with a reduced-firing rate, but hold to the 70-F-per-hr temperature differential. This may involve intermittent firing and completely filling the drum with feedwater, using thermocouples as a guide.

Forced Shutdowns. Now let's look at forced shutdowns. A drum empty of water, but still under steam pressure, experiences serious stresses if relatively cold feedwater comes in contact with the drum surface. Any drum, thick or thin, can withstand a certain number of temperature shocks without damage. But no one can predict just how many.

Damage from such a shock far outweighs any temperature shock that could develop from the low heat given off by accumulated slag in a furnace setting. Because of this possibility, an operator's primary consideration should be safe-guarding the drum. Here is how he can do that. Tables I, II.

A boiler fired with pulverized coal, oil or gas and experiencing a tube rupture, say, should have its fire cut off immediately, the forced draft shut down, and steam output closed off completely. In addition, stop the feedwater flow to the boiler. With this procedure, by the time water within the drum has dropped to where furnace-wall tubes are dry, heat emission from slag or refractory will be so low that no damage will result.

Air flow should be reduced as low as possible: to a point where water or steam escaping from the tube rupture does not blow into the boiler room.

Once pressure in the unit has dropped to zero follow the procedure for a normal shutdown. Do not empty the boiler system of water until the furnace is cool enough to permit a man to enter.

Fuel-Bed Firing. With stoker or other fuel-burning methods where the fire can't be killed instantly, other steps must be taken. The problem resolves itself into a choice between risking damage to (1) drum by continuing the flow of feedwater (2) furnace tubes and boiler structure by shutting off this flow. A majority of stoker-fired units are of lower pressure, and thus danger from quenching drum shells is not so prevalent.

For emergency, shut down the supply of fuel and combustion air. Smother the fire by whatever means have been predetermined or are available without causing a gas explosion. Shut off steam output completely to prevent a sudden drop in pressure and temperature within the boiler.

Keep feedwater flowing to the crippled boiler and try to maintain water level. Do not rob other boilers. Shut off supply entirely after fuel combustion drops to where overheating of pressure parts will not develop—about 15 minutes after the rupture has been detected. From then on, the cooling procedure follows that outlined for pulverized coal, oil or gas-fired units.

But suppose feedwater supply is lost. If pressure parts remain intact, cut the fires out as soon as water level drops out of sight. Conserve all water in the boiler by closing off blowdown and drain valves. Reduce the load on the turbines. This procedure prepares the way before pressure drop makes complete shutdown necessary. In addition this method keeps safety valves from blowing, and if feedwater is restored saves restarting the turbine.

If boiler pressure falls 20% below normal, trip out the turbine. It saves stress from temperature reduction, throughout the boiler and turbine unit, which could develop from abnormal pressure drop. Once feedwater supply is restored deliver water slowly into the drum.

No reference has been made to operating pressures on this shutdown procedure. It has been worked up primarily for high-pressure thick-drum installations but applies equally to low-pressure thin drums.

AUTOMATIC RELEASE, heat-operated, sends carbon dioxide from above cylinders to discharge nozzles in vault on floor below

DISCHARGE NOZZLES are placed at intervals along the pipeline, encircling room. Fire causes carbon dioxide to flood room

Automatic Electrical-Fire Protection

Textile-plant circuit breaker and battery room protected against fire by a carbon-dioxide extinguishing system

By S G FRECK
Manager, Industrial Division
Walter Kidde & Co Inc

► CONTINUOUS MANUFACTURING at the Garfield, N. J. plant of the Forstmann Woolen Co is totally dependent on uninterrupted electrical output from its power house, which has a capacity of 7300 kw. Recently the company installed an automatic carbon-dioxide fire-protection system, which prevents serious damage and costly electrical-power interruption by safeguarding the circuit breaker and emergency lighting battery vault on the station's ground floor.

The room containing the breakers and battery is the supply center for hundreds of circuits in the many plant buildings. It is 107x15 ft, and has steel firedoors—one at each end and two along one side.

Fire-Protection Equipment. Directly above the breaker room, on the operating floor of the power plant, are 28 steel cylinders, each containing 50 lb of liquid carbon dioxide. They are manifolded together for simultaneous discharge in case of fire. The cylinder manifold is connected by simple piping to a series of 20 wide-dispersal discharge nozzles, strategically located along the inside walls of the circuit-breaker vault.

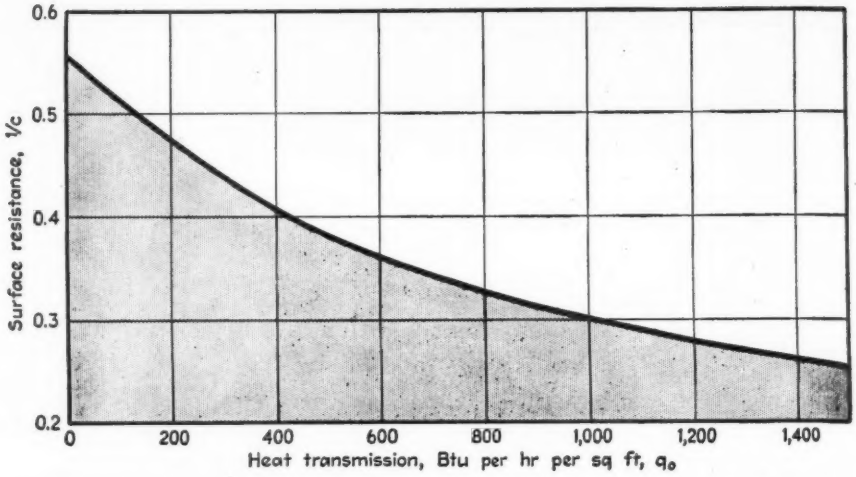
Near the ceiling of the enclosed vault and directly over the breaker units are three heat actuators for detection of excessive temperature rise. They would quickly detect fire in any of the breakers. Automatically operating the cylinder manifold valves, the heat actuators release carbon dioxide through the piping network via discharge nozzles into the vault.

How Equipment Operates. The carbon dioxide provides its own propellent power, as it is stored in cylinders under 850-psi pressure. When this liquid reaches the discharge nozzles and hits the air, it turns into a gas expanding to 450 times its stored volume. Slightly heavier than air, this cloud of gas and dry-ice snow floods the entire fire space, penetrating to every nook and corner of the circuit-breaker vault. This reduces the air's normal oxygen content to below the point where combustion can be supported. Elapsed time between outbreak of fire in the vault and complete extinguishment is only a matter of seconds. In fact, the fire might be out before power-plant attendants even detect it.

At the main door to the circuit-breaker room, which would be closed automatically by a release valve actuated by the discharging gas, are two remote-control break-glass boxes for fire-emergency use. One is for manual cylinder release, used when the system is taken off automatic operation. Manual operation of the fire-protective system is used when maintenance men are working in the vault. Thus they have a chance to leave during a fire before carbon-dioxide gas is released. The other remote-control box sets off the power-house fire alarm, ringing four gongs at various points on the floor.

After the fire is extinguished, there is little cleaning-up to be done since carbon dioxide leaves no messy residue. CO_2 will not damage delicate electrical equipment or machinery.

These three tables are based on thoroughly practical considerations of standard insulation thickness, heat loss, load factor, fixed charges, fuel cost, temperature conditions, operating hours and labor costs



INSULATION SURFACE RESISTANCE depends on the rate of unit heat flow; the resistance decreases with increasing heat transmission through insulation surface

Here Is a Quick Way to Find

III: Column Index for Table II on Economical Thickness of Insulation

Heat cost, ¢ per 10^6 Btu		20	25	30	35	40	45	50	55	60
Estimated operation, hr per yr	*Annual fixed charges, %*	*Column number*								
8760	15	5	6	7	8	9	9	10	10	10
7200	15	5	6	6	7	8	8	9	9	10
6000	15	4	5	6	6	7	7	8	8	9
5000	15	3	4	5	5	6	7	7	8	9
8760	20	4	5	6	7	7	8	8	9	9
7200	20	3	4	5	6	6	7	7	8	8
6000	20	2	3	4	5	6	6	7	7	7
5000	20	2	3	3	4	5	5	6	6	7
8760	25	3	4	5	6	6	7	7	8	8
7200	25	2	3	4	5	5	6	6	7	7
6000	25	1	2	3	4	5	5	6	6	6
5000	25	1	2	2	3	4	4	5	5	6

► RECOMMENDATIONS by the industry for the economical thickness of 85% magnesia insulation have ordinarily been based on one factor, range of operating temperature; for pipe insulation, pipe sizes have also been considered. These recommendations have rarely taken account of other operating variables.

To assist in finding the most economical thickness of pipe insulation, a study incorporating tables of economical thickness for varying hours of operation, cost of heat, amortization rate, temperature range and pipe size was prepared by the Magnesia Insulation Manufacturers Association and published by the American Society of Heating and Ventilating Engineers*.

A similar study of block insulation, prepared to aid in selecting the most economical thickness of single-layer 85% magnesia block insulation, is reported in the following discussion. As the majority of block insulations are finished with ½-in. asbestos cement, this factor has been taken into account in the calculations.

Heat-Loss Calculation. Table I was calculated with the following established equations for heat transmission:

$$q_0 = \frac{t_1 - t_a}{\frac{d_1}{k_1} + \frac{d_2}{k_2} + \frac{1}{c}}$$

$$U_1 = \frac{q_0}{t_1 - t_a}$$

where

q_0 = heat transmission, Btu per sq ft per hr
t_1 = temperature of hot surface of insulation, F
t_a = temperature of air on cool side of insulation, F
d_1 = thickness of first material (85% magnesia block), in.
d_2 = thickness of second material (asbestos-cement finish), in.
k_1 = conductivity of first material at mean temperature, Btu per hr per sq ft per in. per F
k_2 = conductivity of second material at mean temperature, Btu per hr per sq ft per in. per F
c = air-film conductivity, Btu per hr per sq ft per F
U_1 = heat-transmission coefficient, Btu per hr per sq ft per F

The curve shows the relationship between the surface resistance (1/c) and total heat transmission. The resistance decreases as the heat transmission increases.

Values of k_1 for 85% magnesia were

* *ASHVE Journal*, Section of Heating, Piping and Air Conditioning, October 1947.

I: Unit Heat Loss for 85% Magnesia Block Insulation, ½-in. Asbestos Cement Finish

Vertical Position

*Difference, F**	100	200	300	400	500
Block thickness, in.	*Heat loss, Btu per sq ft per hr per F*				
1	0.297	0.308	0.320	0.332	0.344
1½	0.216	0.224	0.233	0.242	0.250
2	0.170	0.176	0.183	0.190	0.196
2½	0.140	0.145	0.150	0.156	0.161
3	0.119	0.1235	0.128	0.1325	0.137

* Hot surface to air

II: Thickness of Insulation Recommended as Economical

Column number	1	2	3	4	5	6	7	8	9	10
Hot surface temperature, F	*Insulation thickness, in.*									
180	1	1	1	1	1	1	1½	1½	2	2
212 to 266	1	1	1	1	1	1½	1½	2	2	2½
267 to 337	1	1	1	1½	1½	1½	2	2	2½	3
338 to 387	1	1	1½	1½	2	2	2½	2½	3	3
388 to 499	1	1½	1½	2	2	2½	2½	3	3	3
500 to 600	1½	2	2	2½	2½	3	3	3	3	3

Economical Insulation Thickness

obtained from conductivity tests made by the insulation manufacturers:

Conductivity Tests

Mean temperature, F	*k*
100	0.39
300	0.45
500	0.51

The conductivity, k_2, for asbestos cement was assumed to be 1.50 for all mean-temperature values.

Insulation Thickness. Cost of applying insulation blocks is made up of the following items: (1) 85% magnesia block insulation (2) hexagonal wire mesh (3) asbestos cement finish (4) labor. Cost of wire wesh and asbestos-cement finish is independent of block-insulation thickness, so total cost should vary only with labor and block thickness.

Consensus of the insulation contracting industry states that theoretically there should be a slight increase in cost of application per sq ft of block with increasing thickness, but the difference is so slight that using a variable labor figure is not justifiable. Therefore, it is assumed that an insulation mechanic would apply about the same square footage per day of any single layer thickness of block from 1 to 3 in. thick. Hence, the only cost variable for the finished installation has been the cost of this block insulation, taken as 22¢ per board foot. This figure is based on a 1947 survey among insulation contractors in various sections of the country. All other costs are fixed and need not be considered to establish economical thickness provided the surface is to be insulated at all.

The economical thickness results in the smallest sum per year of cost of insulation and cost of heat lost through the insulation.

Example:

Cost of heat, ¢ per 10^6 Btu	50
Annual hr of operation	7200
Fixed charge rate, %	20
Boiler steam pressure, psig	100
Steam temperature, F	338
Air temperature, F	75

Annual cost of insulation, $
= 0.22 × fixed charge rate × thickness
= 0.22 × 0.20 × 1 = $0.044 per year

Cost of heat lost annually
= hr operation × heat cost × $U_1 \times (t_1 - t_a)$

$$= 7200 \times \frac{0.50}{10^6} \times 0.315 \times (338\text{–}75)$$

= $0.298 per year

Similar calculations for other thicknesses result in the following annual costs:

Calculations for Other Thicknesses

Insulation thickness, in.	Annual costs, $ — Insulation	Heat	Total
1	0.044	0.298	0.342
1½	0.066	0.218	0.284
2½	0.088	0.170	0.258
2½	0.110	0.139	0.249
3	0.132	0.119	0.251

The above table shows minimum cost occurs with the 2½-in. thickness, which is then the economic choice.

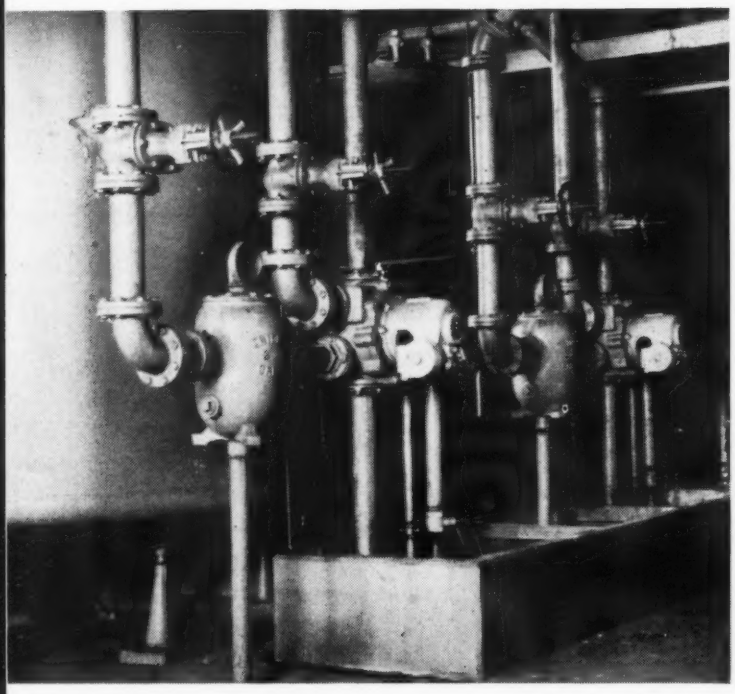
Table II was calculated on the above basis for conditions varying over the following ranges:

Heat cost, ¢ per 10^6 Btu.....20 to 60
Operation, hr per yr.....5000 to 8760
Fixed charges, %.....10 to 25

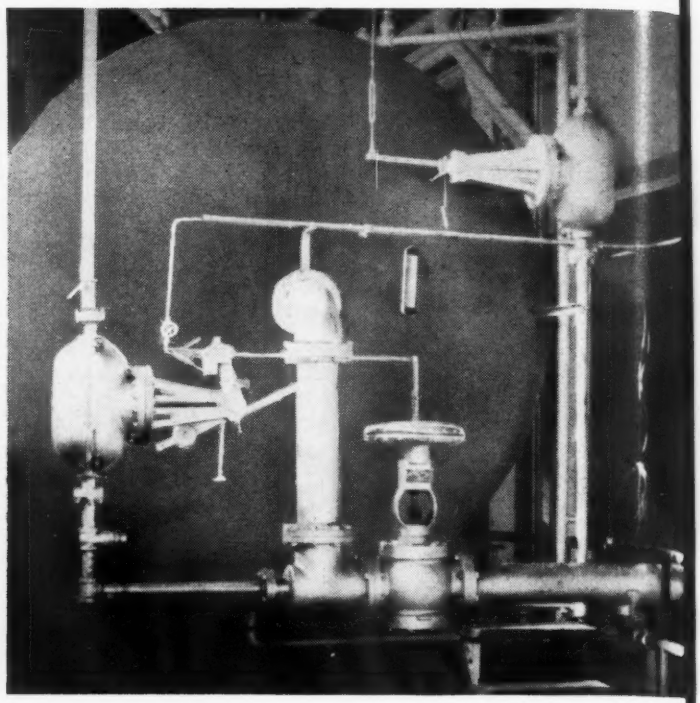
To use Table II, first refer to Table III to find the column number corresponding to the desired hours of operation, fixed charge rate and heat cost. With the column number and initial steam temperature find the economical thickness in Table II. For the example worked out above, Table III shows that column No. 7 applies. Then in Table II, under column 7 opposite 338 F find the economic thickness of 2½ in.

STEEL MILL POWER

When steel-mill engineers talk power, it's with a capital "P". Jones & Laughlin's new 5-stand tandem mill at the Aliquippa Works, which has rolled strip at 6250 fpm (over 71 miles per hr), takes the output of two huge mg sets rated at 14,200 kw. Designed and built by Mesta Machine Co, the mill has six GE motors with a combined capacity of 16,850 hp, which because of special insulation can carry 20,100 hp continuously without overheating. Each of the twin stands has a separate generator to supply dc to its stand and reel motors; with amplidyne control this arrangement makes for ease of operation and fullest possible adjustment of stand speed.



WATER SOFTENERS. Each has peak capacity sufficient for total water requirements with one unit out for regeneration



FEEDWATER HEATER is a deaerator unit of the spray type, which is designed for a normal capacity of 200,000 lb per hr

Feedwater Treatment Removes

When makeup water contained high organic-coloring-matter content, softening was unsatisfactory. So a system was designed to remove this trouble. Water is treated inside and outside two h-p boilers

By W P LONDON
H G Acres & Co., Niagara Falls, Ont.

► SUCCESSFUL OPERATION of a steam plant at high pressures and temperatures requires careful attention to feedwater quality, both outside and inside the boilers. When using nearly 100% raw-water makeup that has a troublesome characteristic the problem becomes doubly serious, as in the Fraser Companies' plant extension at Edmunston, N. B. This plant, described in July POWER, pp 64-68, has two 100,000-lb-per-hr boilers operating at 620 psi and 700 F. Here we will report on the feedwater-treating system, an extensive and interesting one.

Water Analysis. Since only a small amount of condensate returns from process, nearly 100% makeup is used in the boilers. Raw water is taken from the Madawaska River as it comes in through the mill-service mains. The table gives an analysis of a typical sample of this water.

The water contains considerable organic coloring matter, an important troublesome characteristic not shown by the analysis. The color is most noticeable in spring but is always present in smaller amounts. Turbidity is also apt to be high in spring.

Feedwater Treatment. Hall Laboratories, feedwater consultants, made analyses and laboratory tests and recommended that treatment include:

1. Coagulation with ferric sulphate at 4.0 pH, followed by filtration to remove color and turbidity.

2. Softening in either sodium-zeolite softeners or combination hydrogen and sodium-zeolite softeners.

3. Reduction of alkalinity, either by acid feed followed by aeration, or by mixing the effluent of hydrogen and sodium-zeolite softeners and then aerating the mixture.

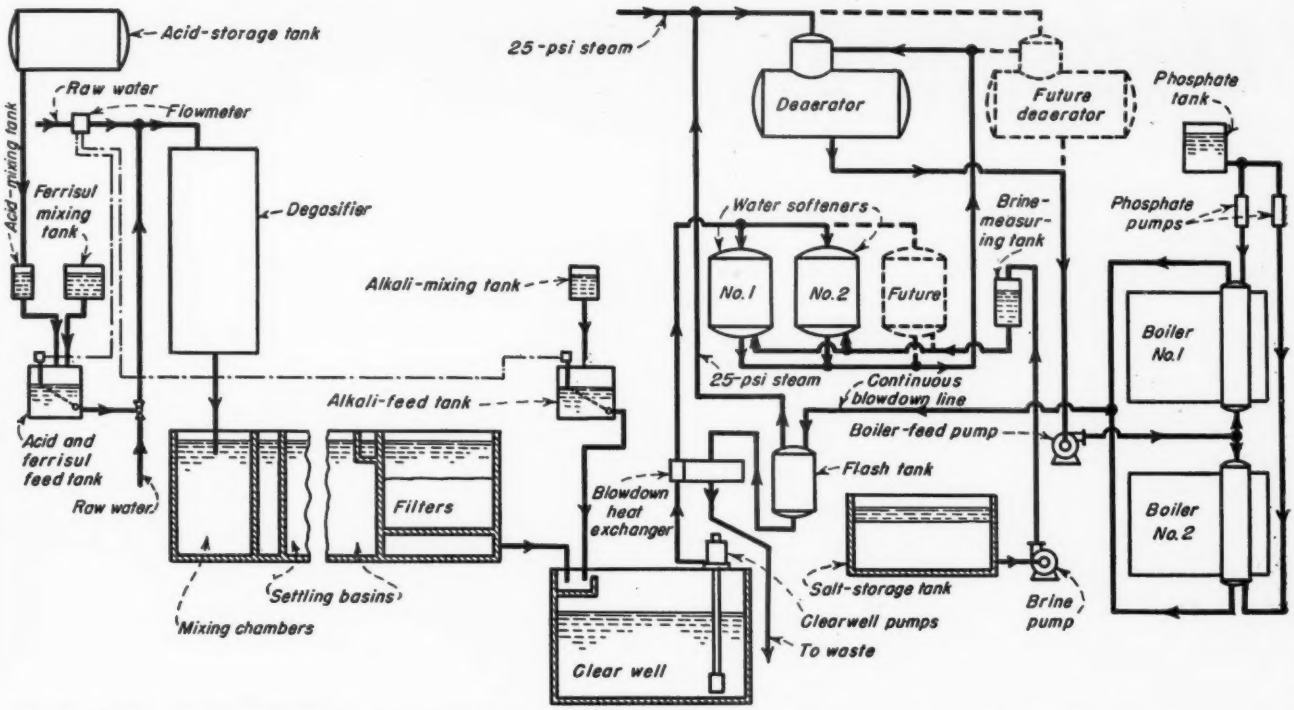
4. Deaeration.

5. Internal treatment with phosphate for removal of residual hardness and for maintaining non-scale-forming conditions in the boilers.

Organic-Matter Removal. No. 1 recommendation requires an installation that is rather expensive but justified. There were good reasons for believing that satisfactory softening was impossible so long as the water had a high content of organic matter. Strongly supporting this view were the experiences in the old plant where a hot-process softener had produced indifferent results for several years.

It was impossible to reduce hardness to a satisfactory value and at times practically no softening at all was obtained. At times tests showed even greater hardness in the softener effluent than in the raw water. Apparently organic matter acts as an inhibiter to prevent softening reactions proceeding at a normal rate.

Removal of organic matter was also desirable because it might cause trouble due to foaming and carryover in the boiler. While no particular difficulty



WATER-TREATING EQUIPMENT. Diagrammatical arrangement of the equipment for treating water at the Edmunston plant. Degasification takes place immediately after the introduction of sulphuric acid and ferric sulphate, used for coagulation

Troublesome Coloring Matter

was experienced in the old plant, this was no doubt because of the relatively large water surfaces and low steaming rates of the boilers. In the new units steam-release rates would be much higher and requirements for prevention of carryover much more severe.

A further advantage of coagulation treatment was complete removal of turbidity. Zeolite softening appeared attractive for this water, because low hardness could be obtained with reasonable chemical costs.

If zeolite softeners were to be used, however, it was necessary to remove suspended matter that might clog up the zeolite bed. Coagulation treatment could do this satisfactorily.

Choice of Coagulant. Choice of ferric sulphate, operating at a low pH, as the coagulant was made only after careful consideration. Installing a large amount of acid-resisting equipment would have added considerably to the cost of the job. Actually, laboratory tests indicated that satisfactory color removal could be obtained by using alum as the coagulant, at a much higher pH. But previous experience of the feedwater consultants had convinced them that such tests were not conclusive. With varying amounts of coloring matter in the water, they felt that conditions were likely to arise under which alum would not prove satisfactory. Moreover, alum was undesirable because of the possibility of small quantities carrying over into the boiler and forming complex aluminum scale.

Alkalinity Reduction. A reduction in alkalinity was desirable to reduce the tendency to produce carryover. Ordinarily an alkalinity between 10 and 20% of total solids in the boiler water is satisfactory; therefore the aim of this treatment is to produce an alkalinity within this range. Alkalinity is reduced by lowering the pH to where all carbonate is converted to free CO_2, then aerating the water to remove this gas.

Treating Equipment. A consideration of several possible equipment arrangements for the treatment led to the conclusion that the one in the diagram would be satisfactory and economical. Degasification takes place immediately after introducing sulphuric acid and ferric sulphate used for coagulation. This makes it possible to add sufficient alkali to raise the pH to 8.0 as soon as the water leaves the filter so pumps and other equipment beyond this point need not be acid-resistant. Moreover, it permits pumping the water in one stage from the clear well through the softeners on to the deaerator.

Typical Analysis, Raw Water From Madawaska River

Bicarbonate (HCO_3)	63 ppm
Sulphate (SO_4)	low
Chloride (Cl)	trace
Silica (SiO_2)	2 ppm
Calcium (Ca)	18
Magnesium (Mg)	2
Soap Hardness ($CaCO_3$)	53
pH	7.6

Coagulating and Filtering. The coagulating and filtering equipment consists of two complete units each designed to handle 270 gpm. At this rate the retention time in the mixing chambers is approximately 30 min and in the settling basins about two hours. The mixing chambers have each four compartments through which the water flows in series. Mechanical agitation in the first compartment gives good mixing and

(*Continued on page* 138)

SPEAKING OF POWER

Add to things that sound screwy but aren't: recent proposals to refrigerate the perma-frost under runways of Alaskan and Canadian air fields. In case "perma-frost" is a new one, it designates that portion of the frozen subsoil that does not thaw in summer months. Refrigeration will, by preventing possible thawing under runway ends, make possible a considerable economy in those portions of the slab subject to landing impact. Even when it's explained it has a sort of "coals to Newcastle" sound, but it's true!

★ ★ ★

We've heard talk in atom circles about automatic "can openers" to remove safely the aluminum containers in which uranium rods for atomic reactors are sealed. Now comes a British report of an achievement "not expected for years, even in America"—a safe means of getting uranium piles hot enough to deliver superheated steam for power generation. According to the report, British scientists working at the Didcot atom station have found a means of overcoming the limitations of aluminum cans, which disintegrate long before the reactor gets hot enough. Details are "secret," of course.

★ ★ ★

The late James H Gallaway—Jim to his legion of friends in the diesel industry—liked to tell this story of his early experiences as a salesman. It seems that shortly after Jim began selling for DeLaVergne many years ago, he got a wire from the home office to hop to a small Southwestern community that was considering installing a municipal diesel plant. Jim had been selling the pipelines and a municipal deal was a new one to him.

He approached the problem, as he thought, most intelligently and first looked over the composition of the town board. He found that the chief engineer of the municipal water plant was on the board and Jim decided that his strategy was to sell the engineer and let him sell the board. So he headed first for the water plant.

He found the chief engineer and much to his surprise got an extremely cold reception when he introduced himself as the DeLaVergne representative. Pressed for his reasons, the chief said, "Why you DeLaVergne people are practically frauds. You build an engine with a conical top on the piston (the famous old DeLaVergne design) and any engineer knows you can't hold the pressure on it—it just slides off."

Always quick-witted, Jim admired the engineer's perspicacity, confided that DeLaVergne engineers had discovered the same trouble and had, just recently, revised the design to include additional piston rings to hold the pressure. Then came the clincher: "You'll have to admit that if we *can* hold the pressure, the conical head is an advantage—there's more area for the pressure to work on!"

The light of comprehension slowly dawned in the engineer's eyes as he jumped from one misconception to another. "You know," he said, "I never thought of that."

Firmly convinced, the chief engineer sold DeLaVergne engine to the town board—which once again demonstrates the occasional truth of the old wisecrack that an engineer is a man who reasons from insufficient evidence, by methods that are often faulty, and hits the right answer more often than not.

★ ★ ★

A tank car of more than 6000 gal of crude shale oil—the first bulk shipment from the Bureau of Mines new shale-oil demonstration plant near Rifle, Colo.—recently went to Universal Oil Products Co at Riverside, Ill. where it will be fractionated. Later, Union Oil Co will conduct cracking and other refining studies in its California labs. Work continues at Rifle on experimental mining and extraction. This is part of national synthetic fuels program.

★ ★ ★

For a few minutes recently, POWER and OPERATING ENGINEER editors believed they had evidence that at least one reader thought their material was worth as much as the editors have long privately believed. An air-mail letter from China requesting reprints of the article on restoring flooded electrical equipment (OE for March—reprints on request) carried $340,000 worth of postage. A hasty check on the latest exchange rates for the skyrocketing Chinese dollar brought the editors back to earth; but left one office stamp enthusiast with a choice item.

★ ★ ★

There's a new word creeping into the jargon of Washington's bureaucrats, according to *Business Week*. They're picking it up from atom scientists who discovered during the war that there is such a thing as a million dollars. The word is *megabuck*—you know, like megawatts.

THE COAL CREW

Coal is heavy and Coal is black
And it can't be pumped like oil.
It can't be led, for it hangs right back,
And handling coal is toil.
Coal is dusty and gritty and foul
And hard as the hubs of Hades,
And handling coal will corrode the soul;
It's sure no job for ladies.

But here is the Crew that does that job;
Day after day they do it.
If it can't be done they call it fun
And wallow right on through it.
The coal goes up, and it must go up
If the going be smooth or tough.
And it's not a trick for shovel and pick
But mechanized modern stuff.

The shake-out roars and the motors whine
And ton by stubborn ton
The coal (we hope) slides up the slope
Of the long conveyor's run.
Down through the crusher's ravenous throat
And out on the belt once more
To a slower ride in the dark inside
Of the drag on the Bunker Floor.

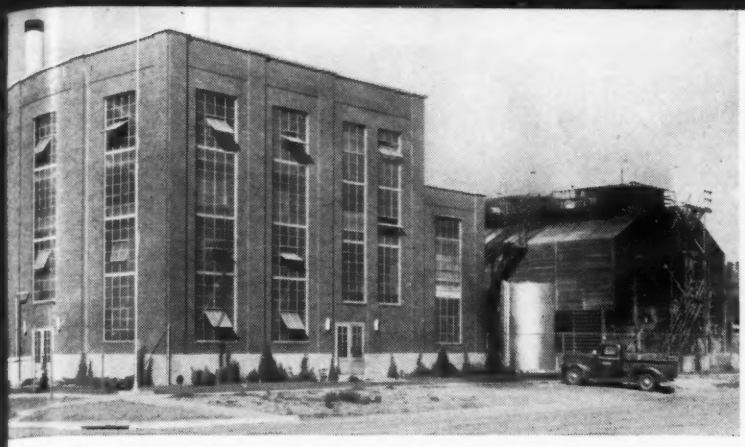
The cavernous bunkers yawn for coal
Day after hungry day.
Unless this crew knows what to do
The devil will be to pay.
For always another boat ties up
Or another train's on track,
And if none comes in they dig like sin
At the storage pile out back.

—R S Clark

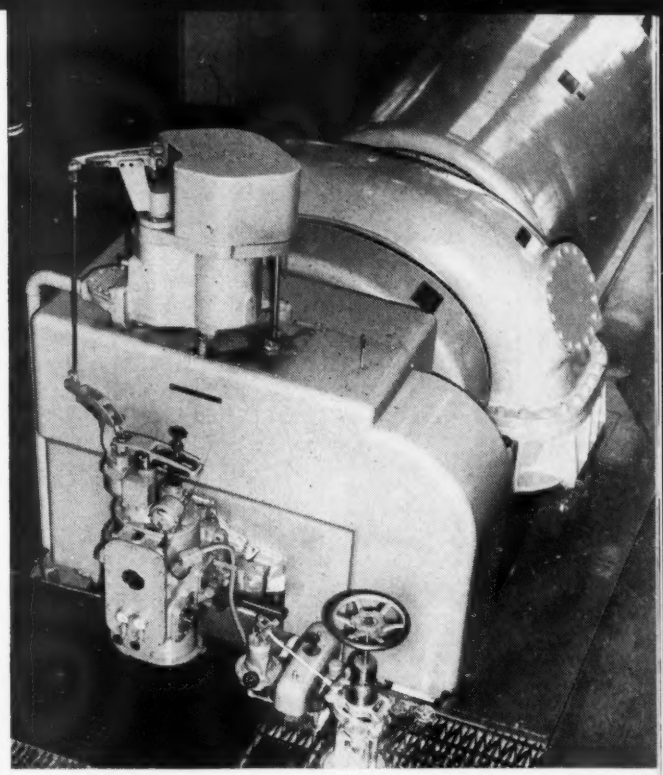
THIS MONTH'S COVER

Because they often simplify piping layouts and save valuable space, axial and mixed-flow vertical circulating pumps turn up with increasing frequency in new installations. Cover shows two Allis-Chalmers mixed-flow units in a Wisconsin Public Service Company plant.

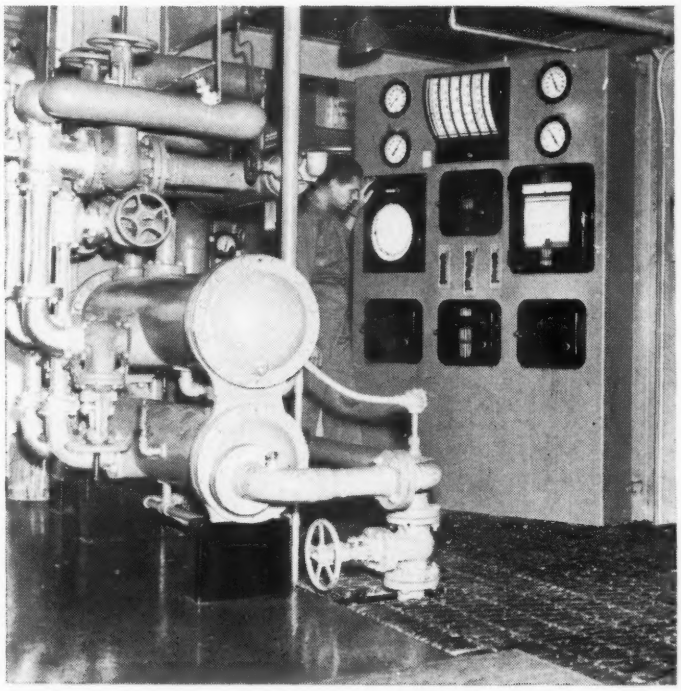
Foreground unit is a 38x24-in. pump rated 11,800 gpm against a 21-ft head. Pump on far side is 52x36 in. and rated at 22,000 gpm against 21 ft. Smaller pump has a 100-hp 580-rpm motor; the larger has a 200-hp 400-rpm drive.



GUYMON STATION, housing one unit at present, uses 10,000-gpm cooling tower, at right, to serve its 6500-sq-ft surface condenser



5000-KW TURBINE, using 400-psig 700-F steam, drives 6250-kva generator at 3600 rpm as well as shaft exciter



BOILER CONTROL PANEL regulates operation of two 33,500-lb-per-hr units, faces two-stage air ejectors serving main condenser

TWO BOILER FEED PUMPS, one motor driven, one turbine driven, are located before two feedwater heaters in plant heat-balance cycle

Guymon Station Takes on Load

By **L L NUNLEY,** ***Chief Engineer***
Guymon, Southwestern Public Service Co

► GUYMON, in the heart of the Oklahoma Panhandle Plains, has outgrown its boundaries and spread rapidly in all directions. This town and others received power from stations some 70 miles away in Texas via a 33-kv loop. A plant at Guymon consisting of two gas engines, 565 and 365 hp each, regulated the 33-kv lines and in emergency carried the town load.

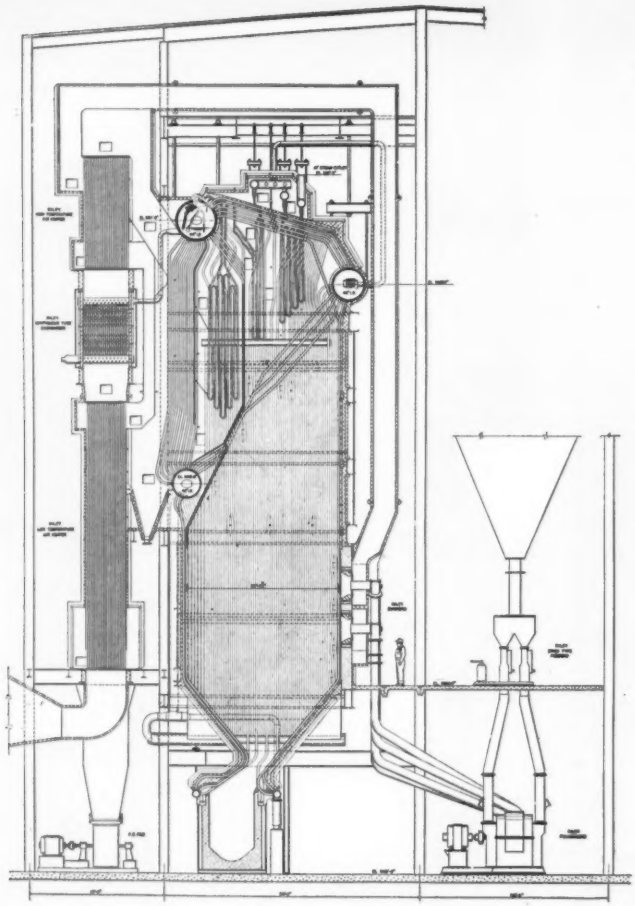
Operation was quite successful until 1943 when the Guymon gas field began to develop. Compressor stations moved in, carbon-black plants, new stores and new homes were built. The sudden growth was too much for the existing means of power supply.

The Southwestern Public Service Co designed the present station in July and August 1945, under M E Strom, design engineer, and construction started in the latter month. Materials were hard to find, strikes delayed deliveries and work progressed slowly because of wartime conditions.

The 6250-kva turbine-generator was given its final check on Jan 18, 1947, and at 8 am on Jan 19, 1947 the unit was synchronized to a 13.8/33-kv transformer and has operated practically continuously since. The unit has been taken off the line twice, once for four

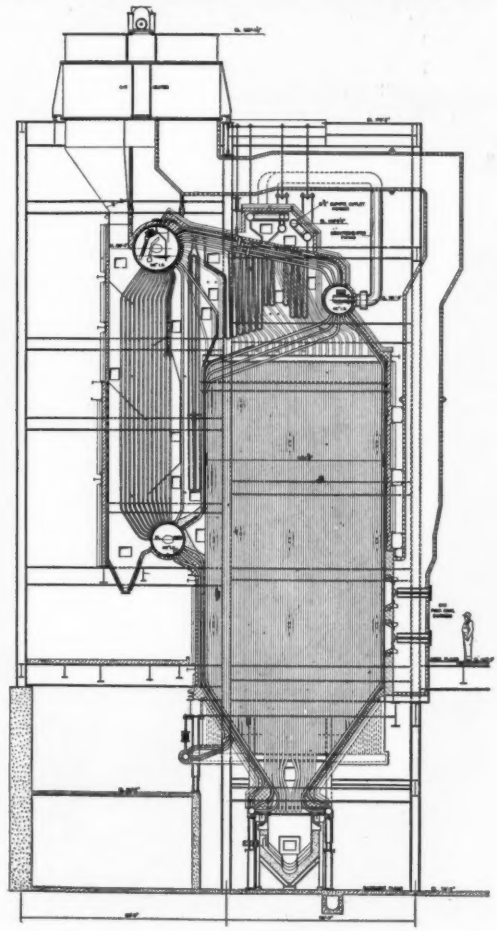
(*Continued on page* 98)

A Few Recent RILEY



NORTHERN VIRGINIA POWER CO., Riverton Station
350,000 lbs./hr. 1050 lbs. 900°F.
Sanderson & Porter, Engineers

PUBLIC SERVICE CO. OF INDIANA, Edwardsport, Ind.
400,000 lbs./hr. 1000 lbs. 910°F.
Sargent & Lundy, Engineers
Public Service Co. of Indiana is also installing
Riley Units in their Dresser and Noblesville plants



All of these Public Utilities have recently ordered Riley Steam Generating Units

HOUSTON LIGHTING & POWER CO.
West Junction Station, 2—850,000 lbs./hr.
Gable Street Station, 1—350,000 lbs./hr.
Greens Bayou Station, 2—675,000 lbs./hr.

CENTRAL OHIO LIGHT CO.
Bluffton Station, 1—120,000 lbs./hr.

UPPER MICHIGAN POWER & LIGHT CO.
Escanaba Station, 1—150,000 lbs./hr.

GULF POWER COMPANY
Pensacola Station, 2—230,000 lbs./hr.

PUBLIC SERVICE CO. OF INDIANA
Dresser Station, 1—300,000 lbs./hr.
Noblesville Station, 3—300,000 lbs./hr.
Edwardsport Station, 2—400,000 lbs./hr.

IOWA-ILLINOIS GAS & ELECTRIC CO.
Davenport Station, 2—250,000 lbs./hr.

INTERSTATE POWER CO.
Lansing Station, 2—120,000 lbs./hr.

WORCESTER COUNTY ELECTRIC CO.
● Webster Street Station, 1—325,000 lbs./hr.

TRADE MARK Rx REGISTERED

RILEY

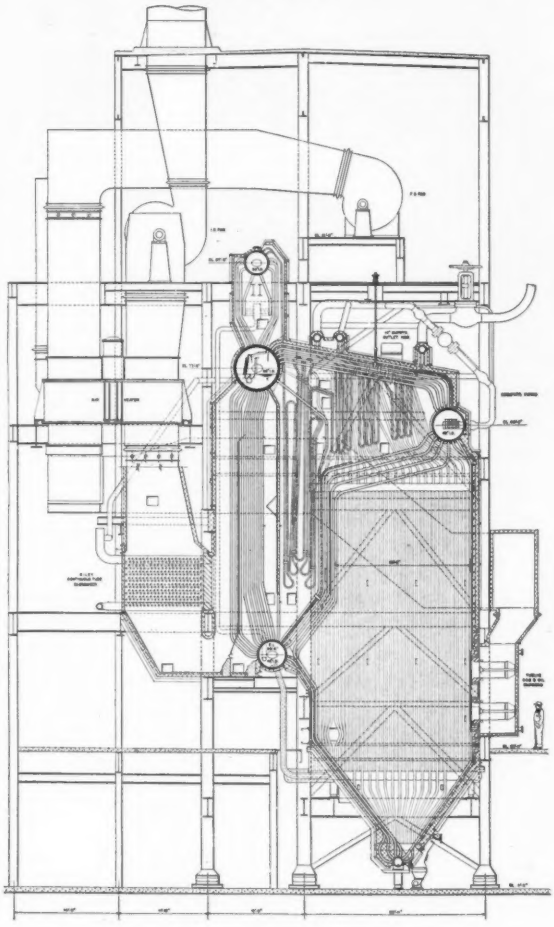
STOKER CORPORATION, WORCESTER, MASS.

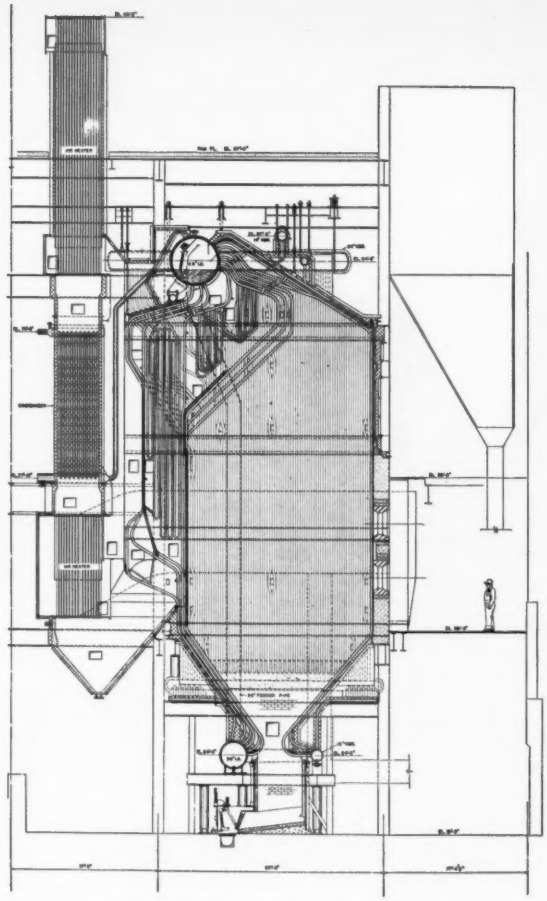
Boston New York Philadelphia Washington Buffalo Cleveland Detroit Chicago St. Louis Cincinnati St. Paul
Pittsburgh Kansas City Denver Seattle Portland Los Angeles Houston New Orleans Atlanta Memphis Tulsa

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS

Central Station Units

CITY OF LOS ANGELES, CALIF., Harbor Steam Plant
825,000 lbs./hr. 1200 lbs. 900°F.
With the addition of these three units,
Harbor Steam Plant will have 3,825,000 lbs. of steam
capacity of Riley Units





CENTRAL ILLINOIS LIGHT CO., Peoria, Ill.
(Commonwealth & Southern Corp.)
300,000 lbs./hr. 925 lbs. 900°F.
With the installation of these two units, Central Illinois
Light Co. will have four Riley Steam Generating Units in
this station

OTTER TAIL POWER CO.
Devils Lake Station, 1—75,000 lbs./hr.
Crookston Station, 2—75,000 lbs./hr.
Wahpeton Station, 1—100,000 lbs./hr.

SOUTHWESTERN PUBLIC SERVICE CO.
Borger, Texas, 1—330,000 lbs./hr.

NEW ORLEANS PUBLIC SERVICE CO.
Market Street Station, 1—330,000 lbs./hr.

SOUTH CAROLINA POWER CO.
Charleston Station, 1—230,000 lbs./hr.

CENTRAL ILLINOIS LIGHT CO.
Peoria Station, 2—300,000 lbs./hr.
Springfield Station, 1—125,000 lbs./hr.

ARKANSAS POWER & LIGHT CO.
Cecil Lynch Station, 1—650,000 lbs./hr.

UTAH POWER & LIGHT CO.
Orem Station, 1—450,000 lbs./hr.

MISSISSIPPI POWER CO.
Hattiesburg Station, 3—230,000 lbs./hr.

OHIO EDISON CO.
Mad River Station, 1—250,000 lbs./hr.
Beech Street Station, 1—90,000 lbs./hr.

NORTHERN VIRGINIA POWER CO.
Riverton Station, 1—350,000 lbs./hr.

CITY OF LOS ANGELES
Harbor Steam Station, 3—825,000 lbs./hr.

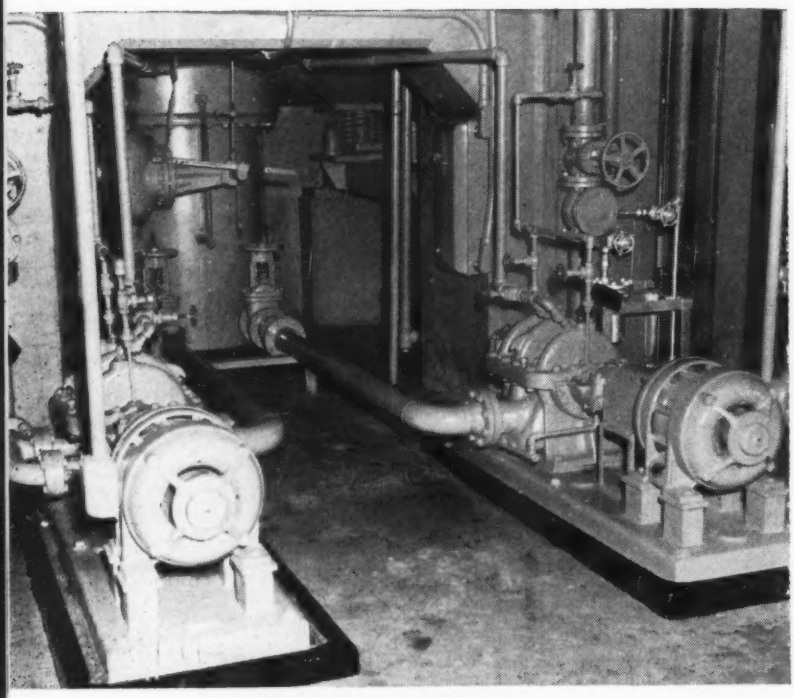
UNION ELECTRIC CO. OF MISSOURI
Ashley Street Station, 3—310,000 lbs./hr.

A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your Power costs

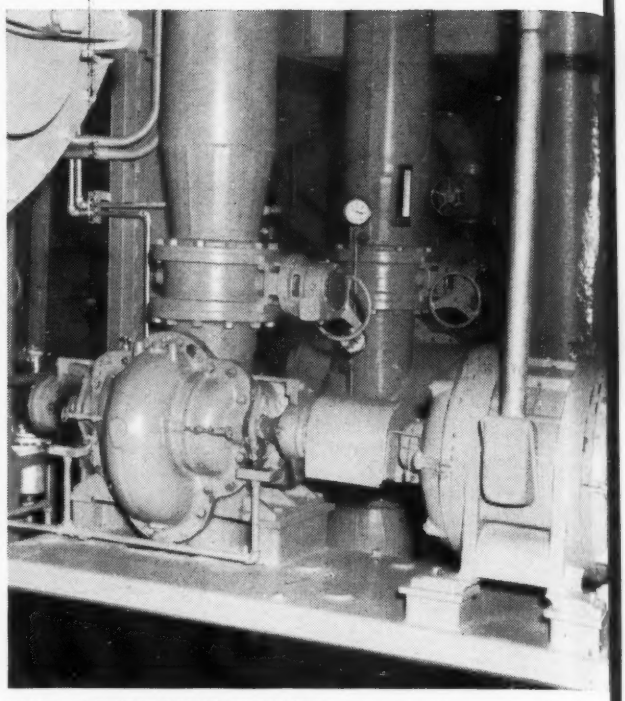
COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS



TWO CONDENSATE PUMPS with motor drives can each handle 130 gpm, the maximum-load station water flow

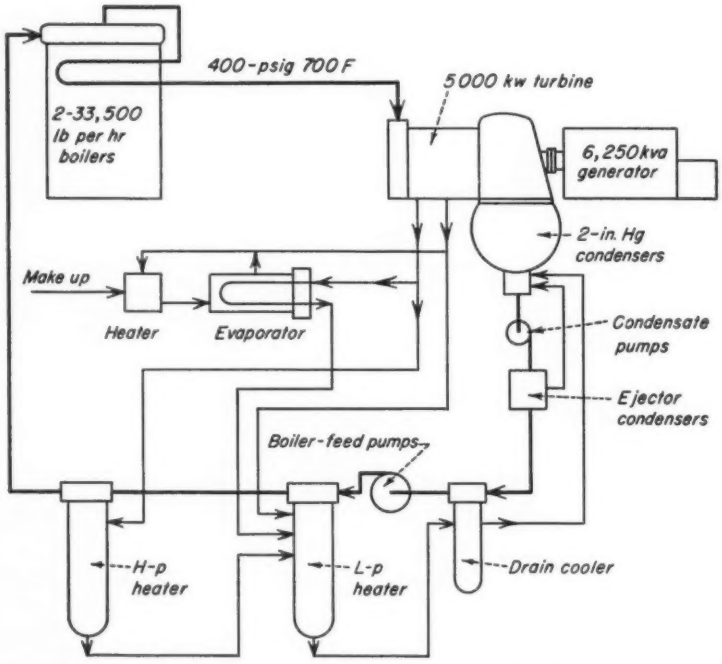


TWO MOTOR-DRIVEN PUMPS take circulating water from cooling tower, force it through two-pass condenser

days to check bearings and worm gears and another time for two hours to repack the primary steam valves.

The plant has operated since starting at an average capacity factor of 96% with a heat rate of 15,670 Btu per net kwhr. Auxiliaries take 5.7% of gross generation. Two separate groups of gas wells, within three miles of the plant, supply the plant fuel. Well pressure of 365 psig delivers the fuel through 4-in. lines. Three sets of regulators control flow to burners. No provisions have been made to burn other fuel types at this plant.

Plant water supply comes directly from the city supply adjacent to the plant. The cooling tower uses the raw water after acid treatment, the alkalinity being held between 40 and 70 ppm. Total solids are carried between 1500 and 1900 ppm and the pH held at about 8.0. Some chlorine is used to prevent algae growth. All makeup water to the boiler feed system is supplied through the 2500-lb-per-hr evaporator.



STATION HEAT-BALANCE cycle uses two closed heaters, drain cooler, tubular air heater, evaporated makeup

Principal Plant Equipment

Guymon Station, Oklahoma

Turbine-generator, 1.....General Electric Co
5000 kw, 400 psig, 700 F, throttle steam 2-in. Hg backpressure, 15 stages, 2 bleed points. 3600-rpm 13,800-v 6250-kva 60-cycle air-cooled. Shaft exciter

Boilers, 2.....Babcock & Wilcox Co
33,500 lb per hr each, 450-psig working pressure, 700 F, gas fired, waterwalls, tubular air heater

Main condenser, 1.....Allis-Chalmers Manufacturing Co
6500 sq ft heat transfer surface, two-pass

Circulating pumps, 2.....Allis-Chalmers Manufacturing Co
5250 gpm each, 100-hp motor drive

Cooling tower, 1.....J F Pritchard Co
10,000 gpm, two 17-ft fans, two 40-hp motor drives

Condensate pumps, 2.....Allis-Chalmers Manufacturing Co
2 stage, 130 gpm, 10-hp motor drive

Boiler feed pumps, 2.....Ingersoll-Rand Co
135 gpm each, 3500 rpm, 1420-ft total head, 1 motor driven, 1 turbine driven

Feedwater regulators, 2.....Bailey Meter Co

Evaporator and heaters.....Struthers-Wells Co

Miscellaneous pumps.....Ingersoll-Rand Co

Air: gas ratio meters.....Cochrane Corp

Air Compressor, 1.....Ingersoll-Rand Co

Automatic Combustion Control.....Leeds & Northrup Co

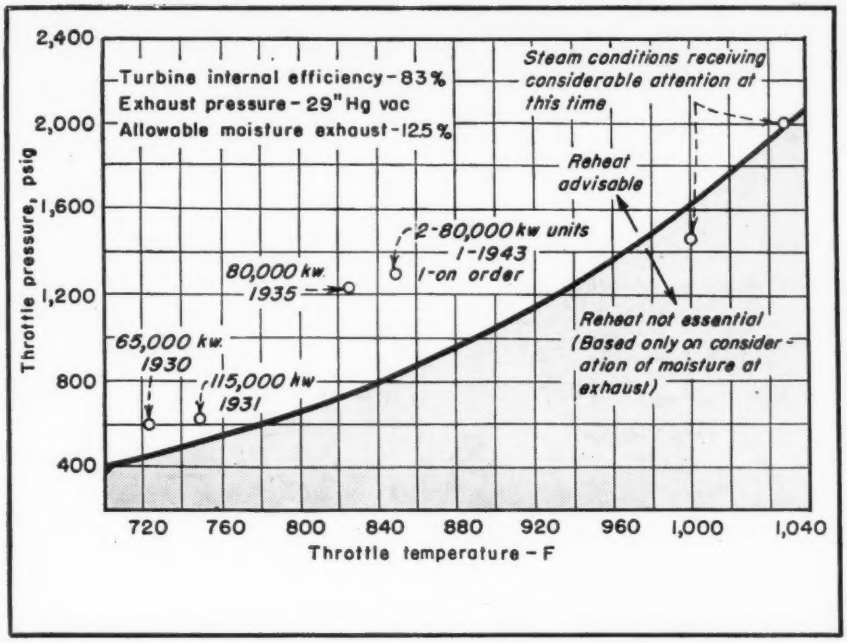
Switchboard, 1.....Allis-Chalmers Manufacturing Co
Air-blast metal-enclosed breakers

Station-power transformer...Allis-Chalmers Manufacturing Co
500-kva 13,800/480-v dry type

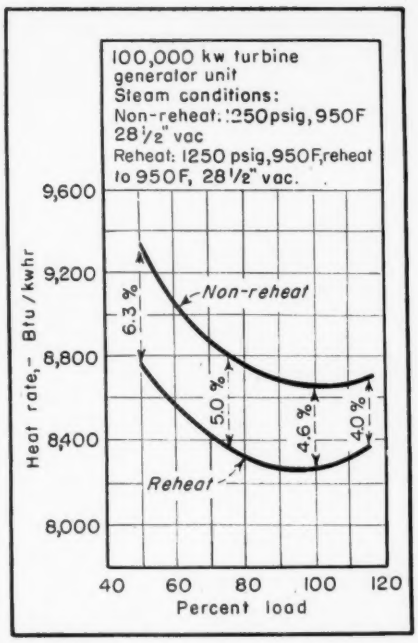
Carrier-current set, 1.....General Electric Co

Station construction.....Bechtol Bros, McCone

Design and Engineering
M E Strom, Southwestern Public Service Co



1 Curve relates throttle pressures and temperatures that produce 12.5% moisture at turbine exhaust, points above curve have higher moisture, below curve less

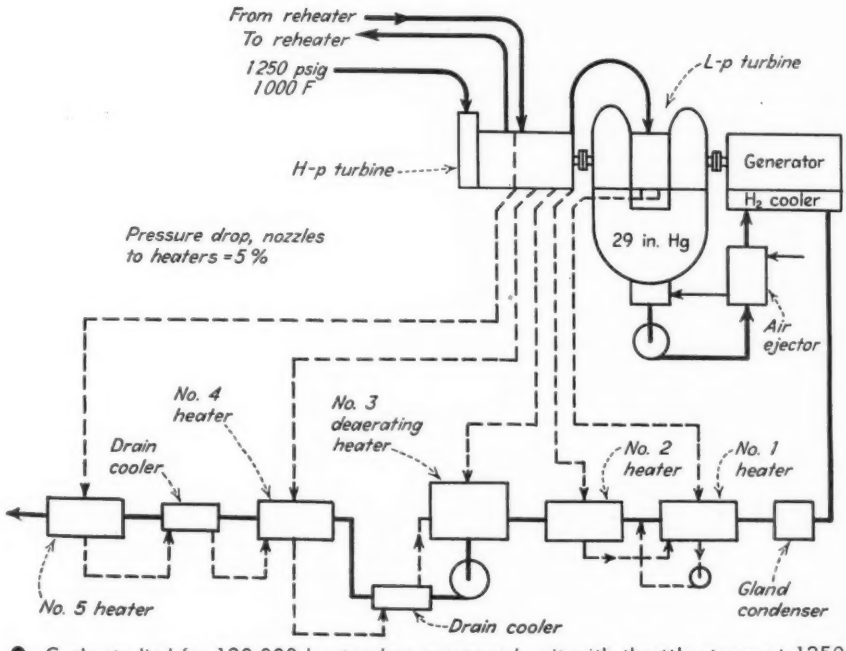


2 Reheat cycle operates at markedly lower heat rates over entire load range

High Fuel Costs Revive Reheating

Originally applied to reduce turbine exhaust moisture with limited throttle temperatures at high pressures, the reheating cycle is now being exploited for its increased efficiencies

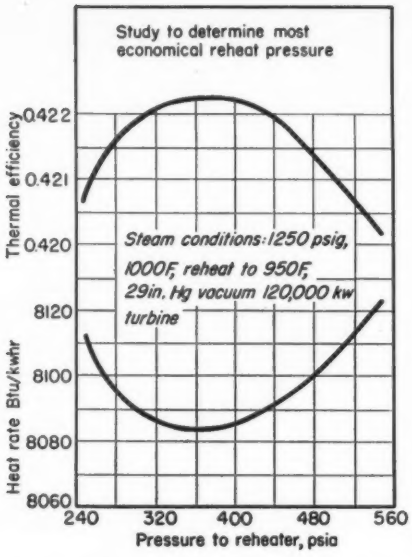
By C W BLOEDORN
Steam Turbine Department
Allis-Chalmers Manufacturing Co.



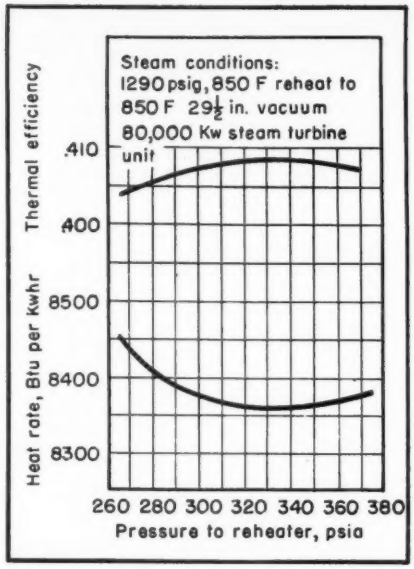
3 Cycle studied for 120,000-kw tandem-compound unit with throttle steam at 1250 psig, 1000 F to determine optimum pressure for reheating to 950-F temperature

▶ THE REHEAT CYCLE is once more receiving serious consideration for new steam-turbine installations. Revived interest comes from the great increase in fuel costs with consequent attempts to improve operating efficiencies above that attainable with straight regenerative cycles and today's steam limits. While the possible gain in thermal efficiency is usually the prime objective in considering reheat now, it was not originally regarded as a direct means to this goal.

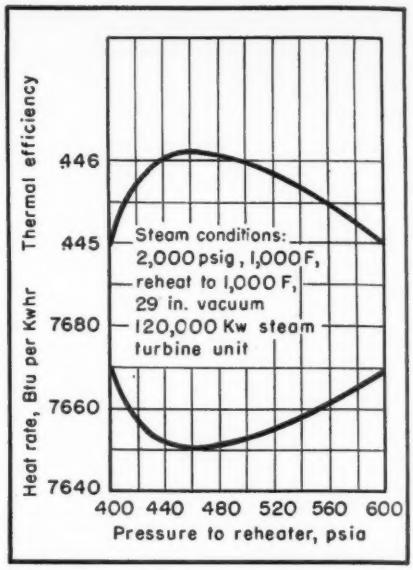
Early Applications. About 20 years ago, reheat was used to reduce the moisture content at turbine exhaust to minimize blade erosion. This in turn permitted higher throttle pressures, at the maximum steam temperatures then allowable, with resulting gain in thermal economy. A curve like Fig. 1 was often a guide to determine if reheat was advisable to reduce moisture content of steam in low-pressure stages. If throttle-steam conditions selected resulted



4 Optimum efficiency and heat rate for cycle in Fig. 3 occurs at 365 psia


Thermal efficiency
Steam conditions: 1290 psig, 850 F reheat to 850 F 29½ in. vacuum 80,000 Kw steam turbine unit
.410
.400
Heat rate, Btu per Kwhr
8500
8400
8300
260 280 300 320 340 360 380
Pressure to reheater, psia

5 All pressure and temperature levels have one best steam-reheat pressure


Thermal efficiency
.446
.445
Steam conditions: 2,000 psig, 1,000 F, reheat to 1,000 F, 29 in. vacuum 120,000 Kw steam turbine unit
Heat rate, Btu per Kwhr
7680
7660
7640
400 440 480 520 560 600
Pressure to reheater, psia

6 Optimum efficiency and heat rate for cycle in Fig. 6 occurs at 460 psia

in a moisture content less than 12 to 13%, there was a feeling among many users that the added complication and cost of reheat installations were not justified.

Also, many engineers were not ready to adopt the unit arrangement of one boiler per turbine, so well suited to reheat. Until the pressure of rising fuel costs was felt recently, less attention was given to reheat and more to increasing thermal efficiency through (1) improving regenerative cycle (2) topping turbines (3) maximum practical throttle pressures and temperatures.

Topping. Topping turbines filled a special need so a considerable number were installed in the late 1930s. Because of limited opportunities, few have been installed in recent years.

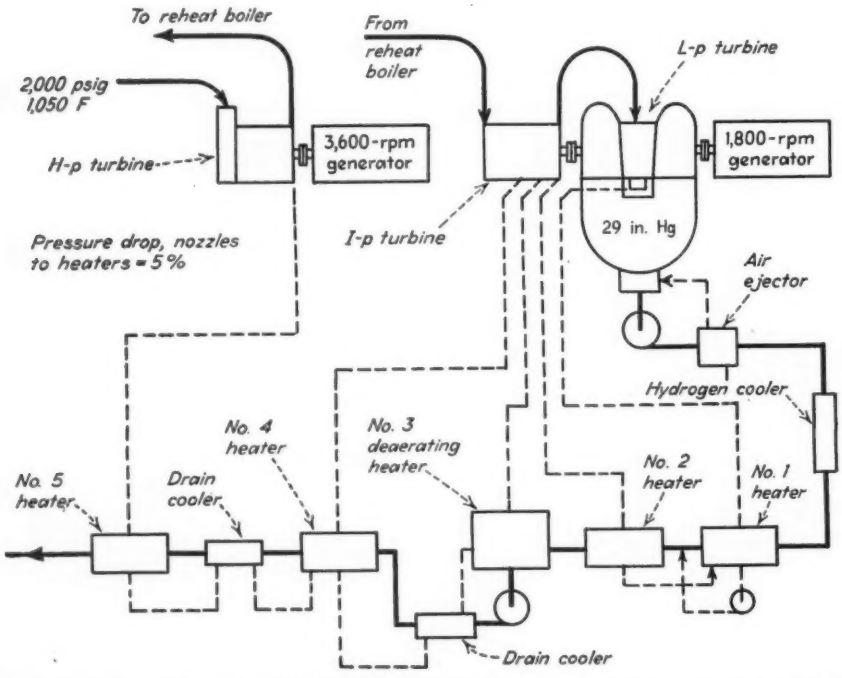
Regenerative Cycle. Also in the late 1930s, much progress was made in using the regenerative feedwater-heating cycle. Four and five stages of feed heating became commonplace in central stations; sometimes even six and seven stages were used.

Throttle Conditions. For 15 years metallurgical developments have permitted steady increase in allowable steam temperatures. With the gain in thermal economy through higher initial temperatures, additional cost and complication of reheat were not considered justified. The present high fuel prices, however, led to considering the combination of reheat with high initial steam conditions, even though the point fell below the Fig. 1 curve.

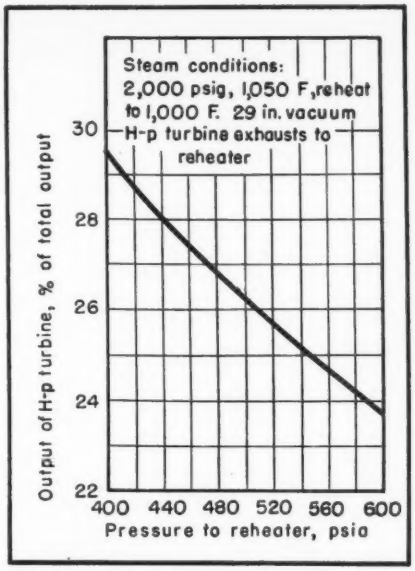
Reheat Operation. There is a definite trend toward wider use of the single-boiler single-turbine arrangement because of proved high availability of modern boilers and the necessity for keeping initial costs as low as possible. Adoption of this setup overcomes some objections to the reheat cycle, which for minimum complication needs a single boiler per turbine.

Power plants that have used the reheat cycle many years report no serious difficulties. Reheat turbines have been put on and off the line as needed with no greater difficulty than with non-reheat machines.

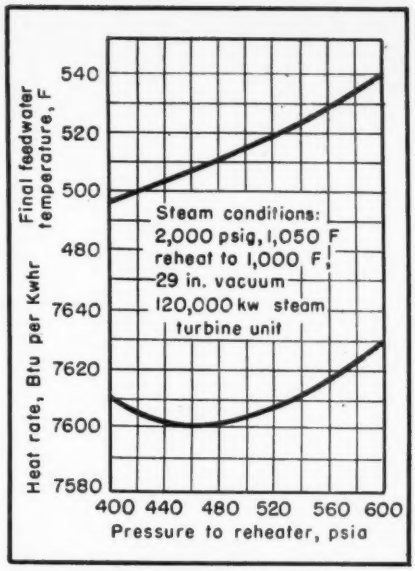
In earlier years, one objection was the large steam volume entrained in reheat lines that might cause overspeeding with load loss. Today, reheat turbines have intercepting valves in the line going to and from turbine to reheat boiler. These valves, under control of the main speed governor, close if turbine speed increases by about 4% above



7 Cycle studied for 120,000-kw cross-compound unit with throttle steam at 2000 psig, 1050 F to determine optimum pressure for reheating to 1000-F temperature



8 Output of h-p turbine decreases with increase in steam reheating pressure



9 With h-p heater above reheat pressure there is an optimum value for latter

normal. This has proved a satisfactory solution to the overspeed problem without undue complication of the turbine governor gear.

Reheat Economy. Estimates indicate that gain in economy by reheat varies from 4 to 6%. Fig. 2 compares heat rates for a typical 100,000-kw nonreheat unit and a similar-size reheat unit. For each, throttle steam conditions are 1250 psig, 950 F; exhaust vacuum is 28½ in. Hg. Feed-heating cycle is the same in both, and reheat is carried to 950 F in the reheat cycle.

Economic analysis, not given, considers initial cost, fuel cost, load factor, reliability, operating convenience, many other variables. Typical analyses show thermal gain may more than offset additional cost and complicating factors.

Reheat Pressure. To find the most desirable pressure to reheat steam for the turbine and its feed-heating cycle, calculations were based on 120,000-kw rating with conditions of 1250 psig, 1000 F at throttle, reheat to 950 F, exhaust at 29 in. vacuum. Calculations were based on the cycle in Fig. 3. This diagram is not necessarily a recommended arrangement, but merely indicates the cycle used for convenience to obtain relative results for comparison. Steam for the h-p heater in each case was extracted from the turbine at reheat belt, before going to reheat boiler. Check figures showed an extraction opening above the reheat point was not practical for this throttle-steam pressure, especially with an economizer.

Fig. 4 shows study results to find the most efficient reheat pressure for this rating. Variation in heat rate over entire range of reheat pressure is only a fraction of 1%. For the conditions set up, optimum reheat pressure is about 365 psia. Since reheat pressure can vary considerably without appreciable change in turbine heat rate, other factors like piping and valve sizes or boiler performance may indicate a different pressure to be more economical from the over-all plant view. These data check with pressures and with throttle to reheat pressure ratios on existing machines.

Fig. 5 shows a similar study for an 80,000-kw turbine for throttle conditions of 1290 psig, 850 F, and 850-F reheat temperature. This machine was actually built to give reheat pressure of 329 psia at the load point for which the analysis was made.

Consideration is being given to large reheat turbines designed for throttle steam conditions in the 2000-psig 1050-F range, reheating to 1000 F. Fig. 7 shows the cycle for making a reheat pressure analysis of a 120,000-kw turbine with these conditions. Unit is the cross-compound type with the h-p 3600-rpm turbine exhausting steam to the reheat boiler and h-p feedwater heater. Steam from the reheater expands in the intermediate-pressure turbine down to 25 psia, then exhausts to the double-flow l-p turbine in tandem with the i-p turbine at 1800 rpm.

Fig. 6 shows again that efficiency variation with pressure is only a fraction of 1%. Curves indicate a most efficient pressure of about 460 psia for turbine and its feed heating cycle.

In addition to over-all consideration of valve and pipe sizes and boiler performance, with the cross-compound turbine, generator size also depends on reheat pressure, which is the h-p turbine exhaust pressure. Fig. 8 shows output of the h-p 3600-rpm element as a percentage of total output at different exhaust pressures for this element. While this curve was plotted from calculations for the 120,000-kw rating, it can be used for close approximations for larger ratings with the same steam conditions. Since reheat pressure can vary considerably without affecting efficiency, reheat pressure may be selected to give standard ratings for the two generators.

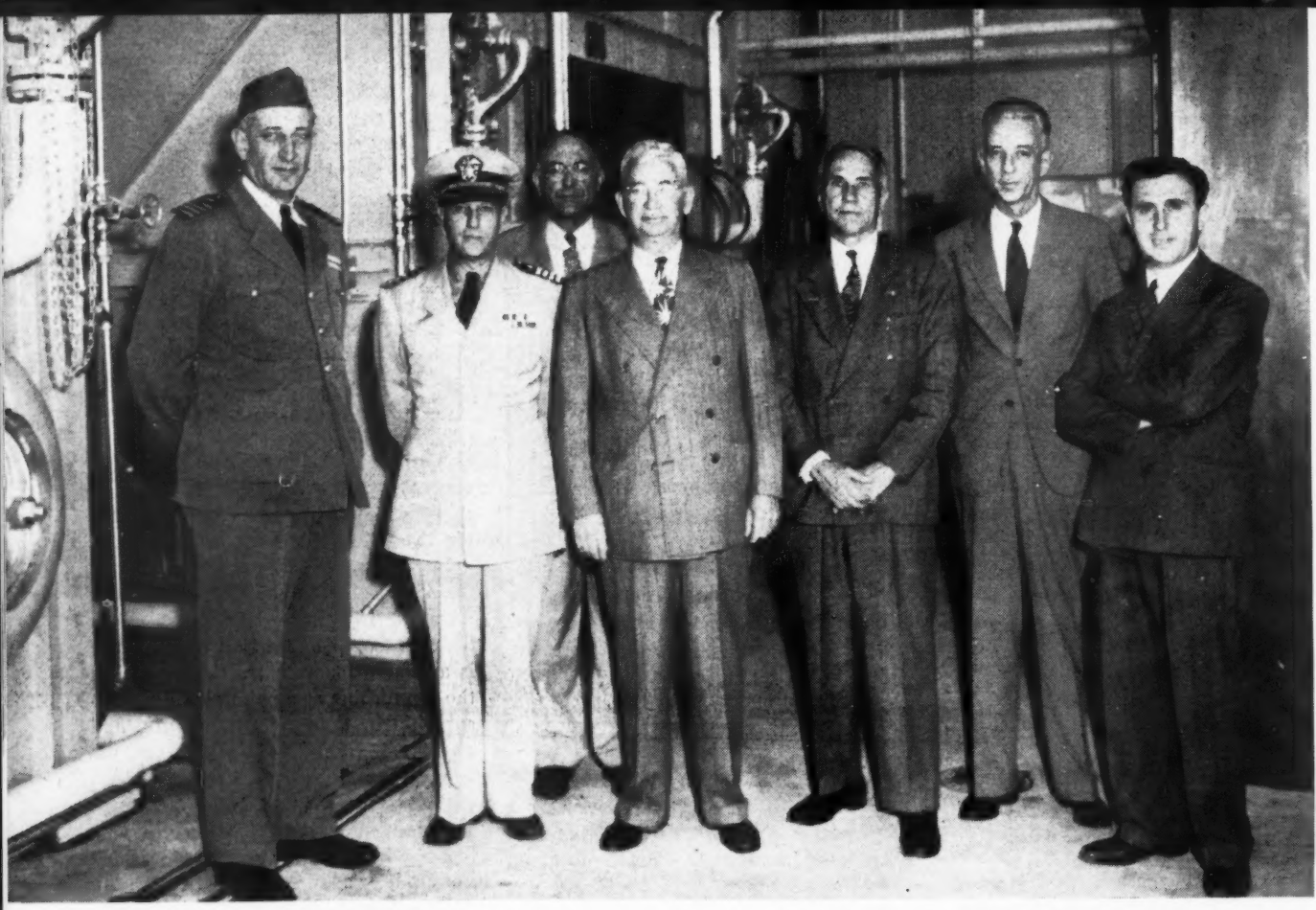
For the results of Fig. 6, steam for the highest-pressure heater was taken from the h-p turbine's exhaust. With the cross-compound arrangement, space is available for an extraction nozzle on the h-p turbine at a point giving a pressure higher than reheat pressure, and another heater can be added to the heating cycle. This can reduce turbine heat rate about 0.6%. Whether over-all plant economics justifies this expense, higher-pressure extraction must be analyzed in each case. With an economizer before the boiler, this heater probably cannot be justified, but some power-plant designers are giving serious consideration to these extremely high-extraction pressures.

Fig. 9 shows results of determining optimum reheat pressure when a final heater at a higher pressure produces final feed temperature. Feed temperature was not held constant in this study, but was varied so an approximately equal rise occurred in the highest-pressure heater in each case.

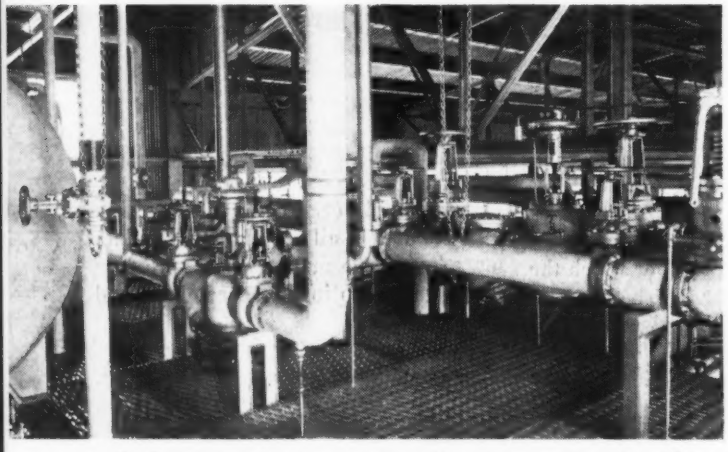
In this as in all calculations for data on reheat performance, a 10% pressure drop was taken in the reheat lines and reheat boiler.

Today, problems of the steam-plant designer are more complex than ever, since not only have fuel costs increased, but construction and equipment costs have also jumped in varying proportions. Further increases in pressure and temperature with the straight regenerative cycle have reached the point of diminishing returns. In this new light, designs making use of the reheat cycle are being reconsidered. Naturally, reheat is not the answer to all problems of reduction in power-generation cost but a number of cases can easily justify the additional cost of reheating.

Bibliography. "The Reheat Cycle," by W Wadkin, *Mechanical World*, March 30, 1945. "Is Reheat Coming Back?" *Combustion*, September 1947.

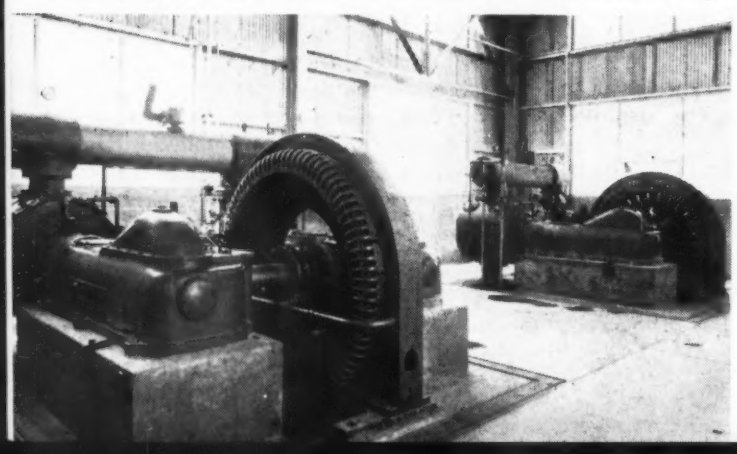


TYING NEW BASE-POWER SERVICES into three plants requires top-flight planning coordination. Here are the men who made it possible; left to right—Capt A K Fogg, public works officer; Capt R Fowler, contract supt; K O Longley, ME; F S Calander, design supt; B Randel, ME; A C Black, chief draftsman; M A Nishkian, vice-pres, chief engineer, Ofcco Construction Co



4 Pressure-reducing stations take steam from the 150-psi main header. One drops pressure to 125 psi, the other to 50

5 Reciprocating two-stage horizontal duplex air compressors deliver 1341 cfm to a receiver tank under 110 psi



Power Services

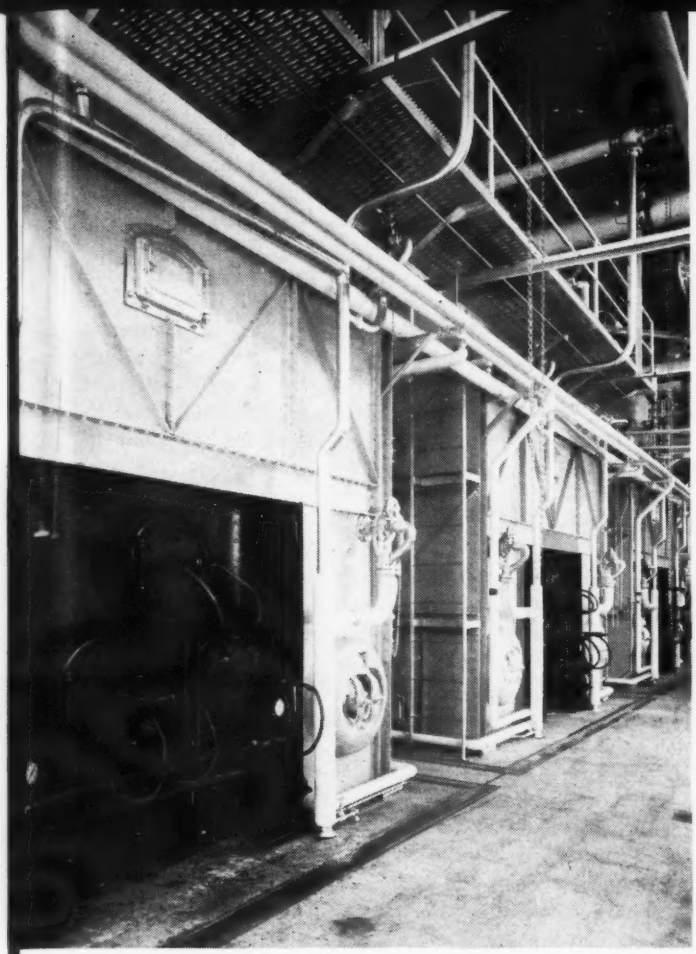
At San Diego Naval Operating Base ships tie up for repairs the full length of piers. To supply power services—water, steam, compressed air—long runs of underground piping and supply lines plus an integrated plant are needed

By **M A NISHKIAN**, *Vice-Pres, Chief Engineer*

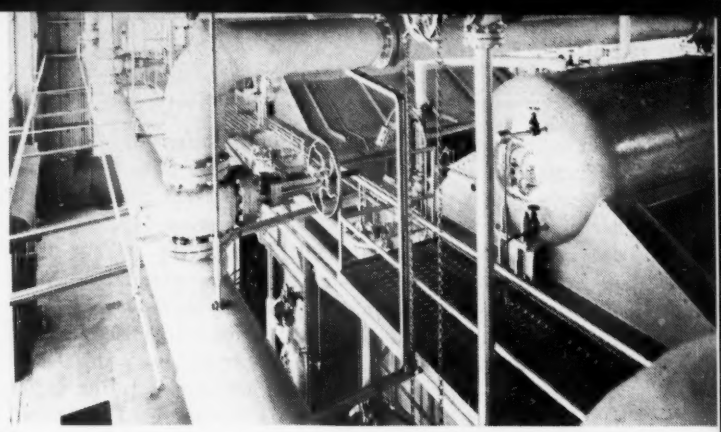
and **GUY LEWIS**, *Project Engineer*
Ofcco Construction Company

► DEPENDABLE ON-SHORE SUPPLY of power services makes up an important part of an adequate naval repair base. Inward-bound naval vessels usually warp into piers, reaching out over a quarter mile beyond the quay, and tie up for repairs—dependent on base facilities from then on. Job of meeting these demands grows with number of ships in port.

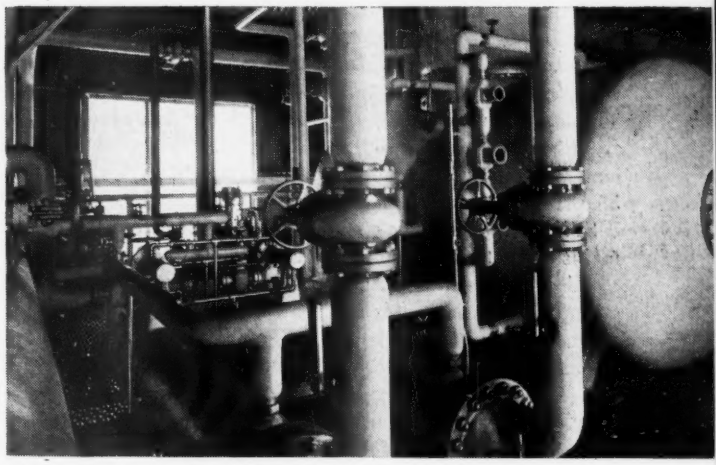
The Eleventh Naval District, San Diego, California re-



1 Steam supply comes from a battery of three 40,000-lb-per-hour three-drum bent-tube oil-fired steam generators. They feed loads at three pressure levels: 125, 50 and 3 psi



2 Distribution of steam to various field mains starts from the main header into which all of the boilers discharge



3 Vertical-spray-type deaerating heater mounted in horizontal storage tank receives treated water from softeners, of 58,500-gal capacity and handling a flow rate of 265 gpm

Meet the Fleet Halfway

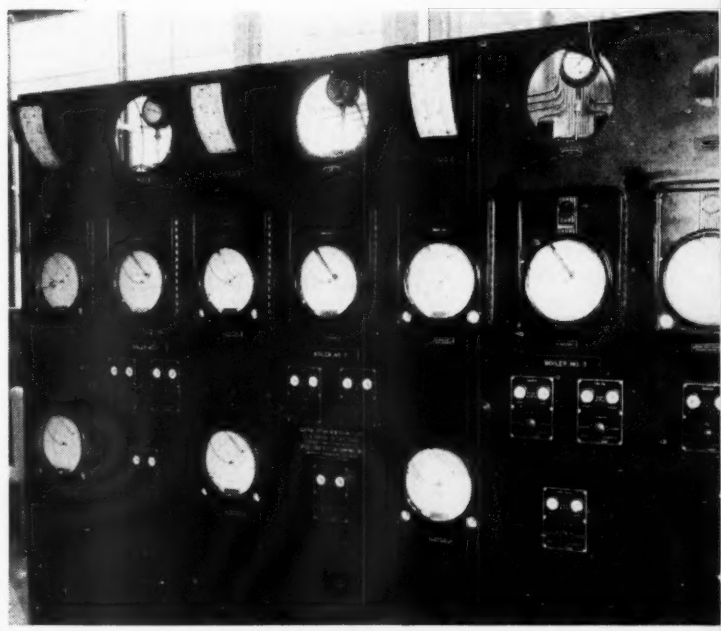
cently completed a large-scale integrated program to provide power services to (1) ships berthed for repair alongside piers (2) buildings in this area (3) convenience outlets throughout the section.

Supply and delivery of these services depend on two sources (1) water from city mains (2) steam and compressed air from a central plant within the base. From here supply lines branch off into groups: one serves piers 4 and 5; a second, piers 6 and 8; the third, piers 10 to 13 inclusive.

The steam-generating and compressor plant is of structural-steel frame with asbestos-protected metal roofing and siding, cast-in-place concrete piling. A concrete, 50,000-gal dual-fuel oil tank and a 25,000-gal concrete water tank lie underground.

Steam Generation. Steam comes from a battery of three 40,000-lb-per-hr 3-drum bent-tube oil-fired steam generators, Fig. 1, under a central-control panel, Fig. 6. They deliver steam at 150 psi, saturated, to a main header, Fig. 2, and from there through control valves to a series of field mains. These mains, in turn, supply local distribution systems for final steam use. With such a widespread steam-distribution system (see below) return of condensate is fairly small.

Water Treatment. So a water-treating plant, employing two complete pressure zeolite water softeners, has been put in service. Each softener can handle a flow rate of 265



6 Main instrument and control panel (before pressure gages were installed) serves the central steam-generating plant

gpm and has a capacity between regenerations of 58,500 gal.

Treated water from the softening system passes through a vertical, spray-type deaerating heater, Fig. 3, mounted on a horizontal storage tank. The combination is capable of deaerating and heating 125,000 lb per hr of makeup from 70 F to approximate saturated-steam temperature and hold in storage about a 20-minute supply of feedwater.

Two steam-driven pumps and one motor-driven boiler feed pump pull water from this heater assembly to discharge into the main feedwater line. Feedwater flow to the boiler drum is under the control of an air-operated 3-element regulator.

A continuous blowoff system holds boiler-water concentration at a maximum of 2500 ppm. Total blowoff reaches 6000 lb per hr for the three boilers.

Steam Distribution. Main steam header has two pressure-reducing stations, Fig. 4, with bypass connections installed. The first with a capacity of 120,000 lb per hr reduces steam from header pressure of 150 to 125 psi. The second station can handle 25,000 lb per hr, reducing steam from 150 to 50 psi for service heaters and feedwater heater.

Still another reducing station takes steam from the 50-psi mains down to 3 psi and supplies 18,000 lb per hr.

All surfaces—piping, appurtenances, apparatus—carrying steam, hot oil, hot water and hot condensate employ an 85% magnesia insulation covering.

Plant steam distribution consists of a network of several thousand feet of piping that extends from boiler house to quay wall. Branches take up from this point and supply out to the end of the piers as well as any miscellaneous outlets along this length.

Piping from boiler house to quay wall lies underground. All control valves, expansion joints and branch connections are in reinforced concrete manholes. Service leads from quay wall to the pier end are installed in the open below the pier decks. Standard-weight black-steel pipe, used throughout, lies directly on the ground, submerged in water or out in the open. It has been made immune, for all practical purposes, to the action of water, gas and alkaline agents as well as to electrolysis.

A patented type of insulation, known as Durant, was applied. It covers the bare pipe with a double thickness of 85% magnesia sections. Over this comes a one-in.-thick coating of poured high-grade asphaltum, with a melting point of not less than 2300 F. A galvanized-steel sheet, 24 gauge thick, protects the asphalt-covering. Arrangement of pipe and covering permits free expansion of pipe without injury to covering. The pipe does not bear directly on insulation but intermediate blocks and guides carry pipe weight. The open piping on the piers has the same material for covering plus a heavy bitumastic coating.

Air Supply. Two reciprocating horizontal-duplex 2-stage water-cooled air compressors, Fig. 5, each deliver 1341 cfm of free air measured at 60 F and 30 in. Hg. barometric pressure. Air from the outside passes through an inlet filter and discharges through an aftercooler to a vertical steel tank receiver under a pressure of 110 psi. From the receiver, air goes to the various points of demand along the distribution system under the control of valves.

Water Supply. Two series of piping make up the water distribution system. They carry through both on the shore and on the piers. One, an extension of the 16-in. high-pressure main, goes for industrial service. The other extends the low-pressure system for domestic use. Hose outlets on both systems permit takeoff at intermediate points.

Several miles of various pipe sizes were installed on these systems. Underground, on-shore lines consist of cast-iron pipe with bell and spigot connections. There is one exception—the mains to piers 4 and 5, have about one mile of 16-in. reinforced concrete in lieu of the 16-in. cast iron.

On the piers, outboard of the quay wall, standard-weight seamless steel pipe, treated with several applications of bitumastic coating, serves beneath the pier deck. Spaced risers project from the mains through the pier deck and terminate immediately above in hose-valves where they make convenient connections for adjacent ships along the pier.

Downstream on the base main following the connection to the city-water mains stands an elaborate, especially designed backflow-prevention unit. Its sole service is to keep city and base systems separate.

Main control valves for the 16-in. industrial systems are 400-lb ferro steel, wedge gate ones with horizontal non-rising stems and with gearing in grease-filled housings. These housings are installed directly in the ground with a cast-iron roadway box marked over the operating nut.

The above described power-service program forms only a part of the full-base facilities. It has been built in anticipation of an eventually greater demand than ever before.

Three power plants and connected service-supply systems form the major sources for base needs. These earlier installations are somewhat similar in construction, size and nature to this recent addition.

MAJOR EQUIPMENT IN POWER-SERVICE SYSTEM

Naval Operating Base, Eleventh Naval District, San Diego, California

STEAM EQUIPMENT:

Boilers, 3 ..... Union Iron Works
40,000 lb per hr, 150 psi, saturated, 3-drum, bent-tube
Burners, oil, 9; 3 per boiler ..... Peabody Engineering Corp
Outside mixing, steam atomizing, type M, oil
Oil-supply units, self-contained ..... Ofcco Construction Co
Including pump governor, oil-temp regulator, oil-relief valve
Combustion control, 3 ..... Bailey Meter Co
Air-operated, automatic, metered-type, fuel-to-air ratio
Fans, 3, i-d, 1 per boiler; 25,000 cfm ..... Buffalo Forge Co
One motor-driven, GE Co; 2 turbine-driven, Terry Steam Turbine Co
Pumps, 3 feedwater, deliver 200-psi water ..... Warren Steam Pump Co
One motor-driven, GE Co; 2 steam-driven, Warren Steam Pump Co
Feedwater controller, 1, air-operated, 3-element ..... Bailey Meter Co

WATER TREATMENT:

Water softener ..... Chemco Inc
Press zeolite water-treating system; 2 softeners 58,500 gal each
Cooler, evaporative, 1 ..... Worthington Pump & Mach Corp
160 gpm, 115-95 F, 25-40 psi
Deaerator, 1, 125,000 lb per hr ..... Worthington Pump & Mach Corp
Makeup supply 70 F; outlet water at saturated steam temp
Pressure-reducing stations, 3 ..... Fisher Governor Co
One 150-125 psi, 120,000 lb per hr; one 150-50 psi, 25,000 lb per hr; one 50-3 psi, 18,000 lb per hr
Expansion joints ..... Zallea Bros & Johnson; American District Steam Co

COMPRESSED-AIR SUPPLY:

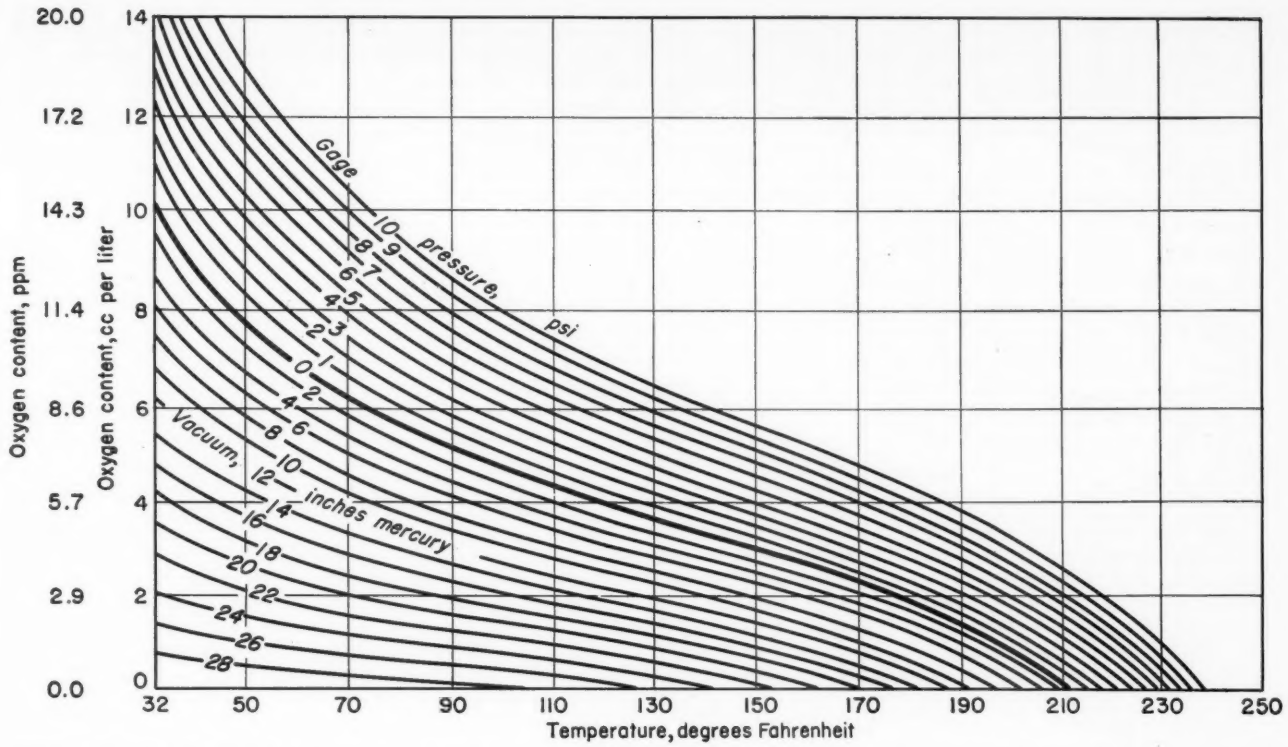
Compressors, 2, reciprocating ..... Ingersoll-Rand Co
Horizontal duplex, 1341 cfm, 2-stage, watercooled, motor-driven

PIPING, VALVES, ETC:

Cast-iron piping ..... U. S. Pipe & Foundry Co
Insulated piping ..... Durant Mfg Co
Valves and fittings ..... Crane Co

MISCELLANEOUS:

Electrical specialties ..... General Electric Co
Conduit, junction boxes, fuses, etc



SOLUBILITY OF OXYGEN in water is quite high at low temperatures, and at the boiling point it approaches zero. The higher the pressure, the greater the solubility. Deaeration at low temperature must take place at pressure that is low

Rid Water of Dissolved Gas To Stop Corrosion

Water that contains a gas like oxygen or CO_2 can damage boilers, heaters, pipelines. Lacking a deaerator use scavengers to absorb the gas, or inhibiters to prevent attack on metal

By R C ULMER, *Technical Director*
Power Chemicals Division, E F Drew & Co, Inc

▶ DISSOLVED GASES like oxygen, carbon dioxide, ammonia and hydrogen sulphide seriously corrode plant equipment that handles water, steam or condensate. Dissolved oxygen normally pits ferrous metals. Carbon dioxide and hydrogen sulphide cause general attack on both ferrous and non-ferrous metals by lowering the solution's pH. Ammonia causes general attack on non-ferrous metals by increasing the pH provided it is raised appreciably above neutral.

The action of each gas is not always as specific as stated. Corrosion may often result from the combined effect of different gases, for example, dissolved oxygen and carbon dioxide. Here the lowered pH caused by carbon dioxide greatly accelerates the pitting action of dissolved oxygen.

Dissolved Oxygen. Water in contact with air dissolves oxygen, river and lake waters normally being saturated with it. Water from wells and domestic distribution mains is usually not saturated. The graph shows solubility of dissolved oxygen at various temperatures and pressures. Solubility is high at low temperatures and approaches zero at the boiling point. The higher the pressure, the greater the solubility.

The factors affecting solubility are used in removing or eliminating dissolved oxygen from water. Deaeration, the commonest method, boils water and at the same time breaks it up into thin films or small droplets to facilitate oxygen release. When deaeration takes place at relatively low temperatures it is called *vacuum or cold-water deaeration*. Principle is the same as deaeration at or near atmospheric boiling point. From the graph it is evident that oxygen solubility does not approach zero until boiling is reached. So it is extremely important that the heater or deaerator temperature be increased to this value.

Even though deaeration may be effi-

cient, some dissolved oxygen usually remains and scavengers such as sodium sulphite, iron compounds and certain organic substances must be used to remove the last traces. If not removed, the inhibiters—nitrate, chromates, etc—may be used to prevent corrosion.

Carbon Dioxide. As with dissolved oxygen, free carbon dioxide can be picked up from air. In addition, waters containing carbonates and bicarbonates may break down when heated and give off this gas. Well waters normally contain more than surface waters. Solubility of carbon dioxide is greatly influenced by pH of the solution, the solubility decreasing with temperature increase and increasing as pressure goes up. The same method, namely deaeration, is used for its removal. Because of its greater solubility, carbon dioxide is more difficult to remove than dissolved oxygen.

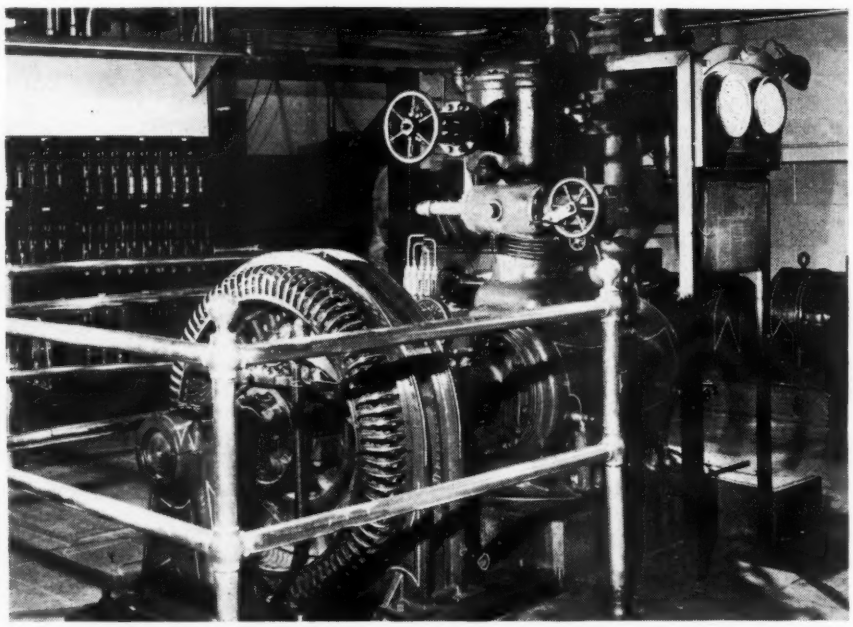
In feedwater systems and boilers, preventing corrosion from free carbon dioxide, carbonates and bicarbonates is simple. Adding an alkali or a complex phosphate is quite effective. But breakdown of carbonates and bicarbonates in the boiler liberates carbon dioxide, which renders the steam and condensate corrosive. Introducing a volatile alkali to the boiler or steam eliminates such corrosion. The amines have been used, and recently organic ammonia compounds were found practical.

Ammonia. Encountered rarely unless water is contaminated with sewage, ammonia is very soluble and cannot be removed by ordinary deaeration; in fact, multiple or fractional distillation is required to get rid of it. Corrosion from ammonia is confined to non-ferrous metals. Fortunately, ammonia itself does not usually cause the difficulty. (In this respect there is considerable controversy regarding the role of ammonia in corrosion.) It is the high pH resulting from ammonia presence that causes corrosion. Consequently, if enough is present to raise the pH to a corrosive value, usually over 8.5, acid treatment can be resorted to or ammonia can be removed with a deammoniator.

Hydrogen Sulphide. This gas rarely causes trouble. As with ammonia it is commonly found in sewage-contaminated waters, although some well waters contain appreciable amounts. Deaeration will usually remove most of it. An alkali to neutralize the acidic hydrogen sulphide may also be added under some conditions.

How to Spot Refrigerating Troubles

Trouble-shooting hints from George Holman tell how to interpret warning signs before a failure causes a shutdown



SPOTTING UNUSUAL NOISES in a machine and identifying their cause before damage occurs is one qualification of a good operator. Any one can stop a wrecked machine

► FAILURES in refrigerating equipment normally warn of impending danger if you know how to read the signs. (These pointers on compressor behavior give distress signals in italics and list causes alphabetically.)

1. *Uneven vibration jars floor and pipes.*

Compressor bearing begins to seize shaft or pin. Do not stop machine, but slow it down at once. Keep it turning slowly a few minutes, if possible. If bearing is exposed, spray with oil.

2. *Uneven pulsations of compressor.*

A: If compressor is double-acting, valves at one end of cylinder are out of order.

B: Worn or loose bearing, crank, crankpin, etc.

3. *Pistons pound as compressor starts.*

A: Oil pump has lost its prime. Bearings are uncushioned by oil. Prime by pressure adjustment, or by pouring oil into pump.

B: Oil filter is stopped up. Clean it thoroughly.

C: Wristpins, crankpins, bearings, etc are out of order.

4. *Quick snapping sound under head of enclosed crankcase of single-acting compressor when starting at low compression ratio.*

A: Poppet-type suction valve strikes safety head. Clean valves and oil system.

B: Weak or broken closing spring of poppet-type suction valve. Inspect and replace with stronger spring.

C: Worn stem and dampening piston of poppet-type suction valve. Replace with precise-machined suction-valve cage.

D: Suction-valve cage does not get oil. Inspect, clean and repair oil system.

5. *Rapid rat-a-tat-tat of poppet-type valves in compressor.*

A: Evaporator floods and liquid carries over into compressor. Stop machine at once. Close expansion valve. Close suc-

(*Continued on page* 138)

ELECTRONICS FOR THE POWER ENGINEER

By F A ANNETT, *Associate Editor*

5—Photoelectric Tubes

► LAST MONTH we learned how electrons in tubes are freed by heating the cathode, a process known as thermionic emission. Here we will study how light or photoelectric emission releases electrons from a metal surface. Tubes for this purpose are popularly known as electric eyes, photocells, photo tubes and photoelectric tubes. The latter is the name by which these tubes are most commonly known, and will be used in this article.

These tubes are applied widely for smoke- and flame-indicating, opening and closing doors, liquid-level control, counting, weighing, and many other purposes. They have an anode and a light-sensitive cathode in a high-vacuum or gas-filled bulb.

Their cathode is usually semicylindrical, Fig. 2, coated with a light-sensitive material such as oxides of cesium, barium, sodium or potassium. Their anode is usually a straight vertical wire, supported in the tube's base. It is partly surrounded by the cathode and made as small as permitted mechanically so as to cast the least possible shadow on the cathode. A light beam is focused on the cathode, as in Fig. 3, which causes electrons to flow to the anode, when a potential is applied across the two.

Light-Sensitive Metals. At this point we will consider why some metals are light-sensitive. They are for the same reason that certain metals are good conductors. In May 1948 POWER, p 105, we learned that the atoms of the best conductors, copper and silver, have each a single electron in their outer orbit, located well away from the nucleus.

The single electron of each atom is assumed to be held loosely and is influenced by adjacent atoms. In this way it is free to move about at random until brought under the influence of a voltage, when it drifts slowly from the negative to the positive terminal of the circuit.

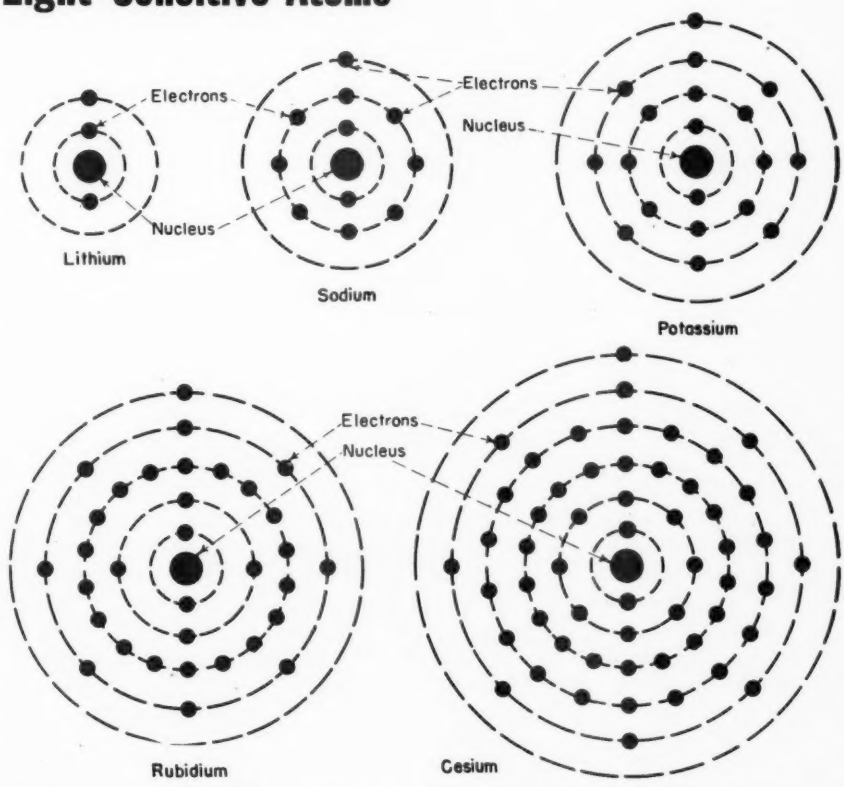
Among the most light-sensitive materials are the alkali metals, lithium, sodium, potassium, rubidium and cesium. Electron arrangement of each is shown in Fig. 1. As would be expected, lithium is the least light-sensitive, the single electron in its outer orbit being the closest to the nucleus of all five elements. On the other hand, cesium, which has the single electron in its outer orbit farthest from the nucleus, is the most light-sensitive.

Unless there is some reason for doing otherwise, cesium and its oxides are most generally used for the cathode coating of photoelectric tubes. Such a cathode may have a silver-plated copper base covered by a thin layer of cesium oxide over which is an exceedingly thin deposit of cesium. Such a construction improves the light sensitivity of the cathode.

Photoelectric tubes with such a cathode are particularly suitable for use with incandescent lamps, as they are 10 to 100 times more light-sensitive than those with other practical cathodes. Such tubes are sensitive to the same light as the human eye and are used in color matching. They are also used in most industrial relays that operate on the interruption, diffusion, deflection, reflection or refraction of a light beam.

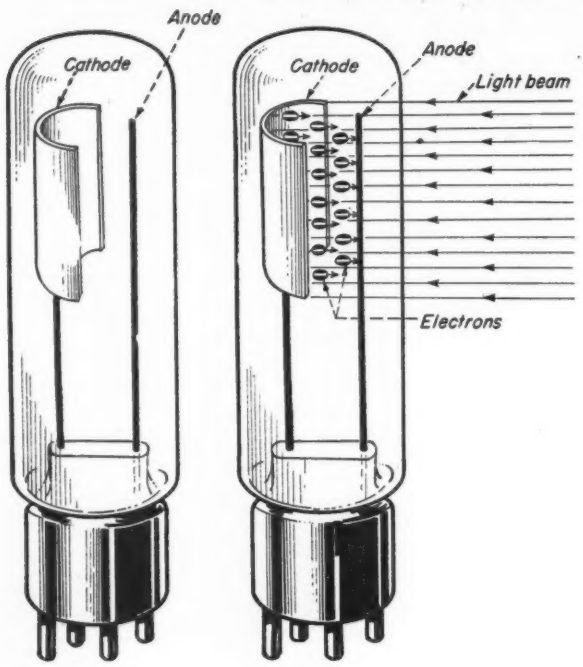
Alkaline earths—barium, strontium,

Light-Sensitive Atoms



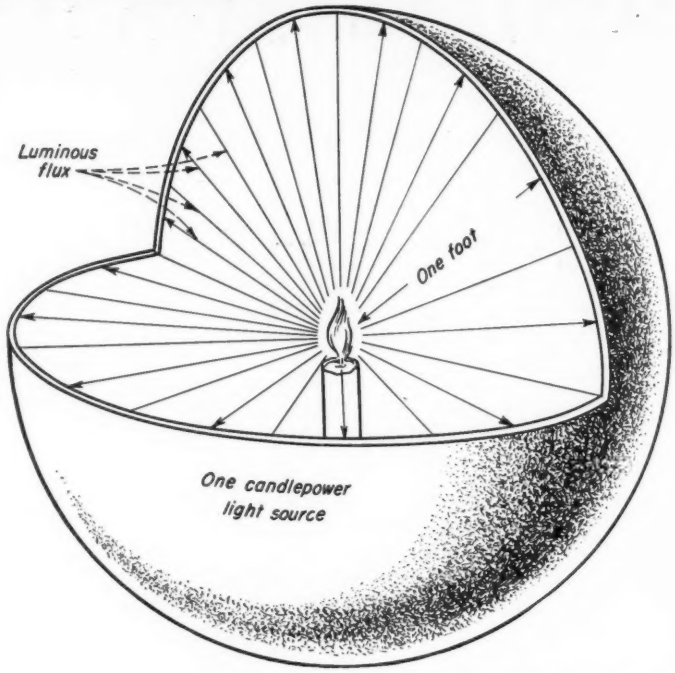
1 Among the most light-sensitive materials are the alkali metals—lithium, sodium, potassium, rubidium and cesium. Light sensitivity increases in order named

Photoelectric Tubes and Unit Light Source



2 Photoelectric tube has a cathode and an anode

3 Beam on cathode causes electron flow to anode



4 A unit light source is an equal distance from all the points on a sphere so that the intensity of the light can be measured

calcium and their oxides—and metals —such as tantalum, titanium and thorium—are used for cathodes of special-purpose photoelectric tubes. Sodium might be used as the light-sensitive element in a tube sensitive to the ultraviolet end of the spectrum. But an ultraviolet-sensitive photoelectric tube, not sensitive to visible light, would have a tantalum-, titanium- or thorium-coated cathode.

Light Flux. When we discussed hot-cathode tubes we learned that with other conditions constant, electron flow through the tubes varied as the current flow through the cathodes. In other words, for a given anode voltage, electron flow through the tube increased or decreased as the cathode's temperature was increased or decreased between limits.

Similarly, in a photoelectric tube for a given anode voltage, electron flow through these tubes is determined largely by the amount of light reaching the cathode. Light is a medium of energy transmission just as an electric current in a circuit is. But we do not speak of light flow as we do of an electric current; we call it light flux or light quantity.

Since light is one of the most important factors when dealing with photoelectric tubes we should have some idea how it is measured. The three most commonly used units are candlepower, foot-candle and lumen. A candlepower is the unit of luminous intensity or unit source of light. It is approximately equal to the light from a $\frac{7}{8}$-in. sperm candle, burning at a rate of 120 grams, or 0.274 oz per hour.

Light is given off from the source in all directions. To have the light source an equal distance from all points on a surface so its intensity can be measured at a given distance, the source is placed in a sphere as in Fig. 4. The standard sphere has a 1-ft radius or 2-ft diameter, as indicated. Then, all points on the sphere's inner surface are 1 ft away from the light source. Under this condition the luminous-flux density on each square foot of surface is called a foot-candle.

In other words, a one-candlepower light source will emit one foot-candle to each square foot of surface one foot away. A luminous-flux density of one foot-candle is a lumen per square foot. Since a sphere 2 ft in diameter has 12.57 sq ft area, a one-candlepower light source emits a total light flux of 12.57 lumens.

Assume we put the one-candlepower light into a 4-ft sphere. We would still have the same quantity of light flux, 12.57 lumens, from the light source but it would be dispersed over four times the area. Now the luminous-flux density will be only $\frac{1}{4}$ foot-candle. From this we see that while the total light flux from a source remains constant, flux density per square foot, foot-candles, varies inversely as the square of the distance from the source—that is, if we double the distance the light intensity decreases to one quarter per unit area.

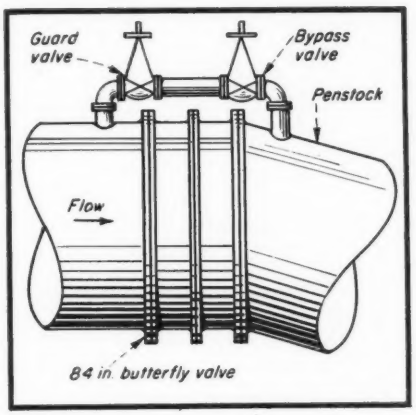
Electric-Lamp Application. How does all this apply to an electric lamp? A 75-watt tungsten gas-filled lamp with frosted bulb is rated 1100 lumens. Assuming such a light source at the center of a sphere 2 ft in diameter, the amount of luminous flux on each square-foot area would be $1100 \div 12.57$, or about 88. Foot-candles equal lumens per square foot; therefore, we have a luminous-flux density per square foot of 88 foot-candles.

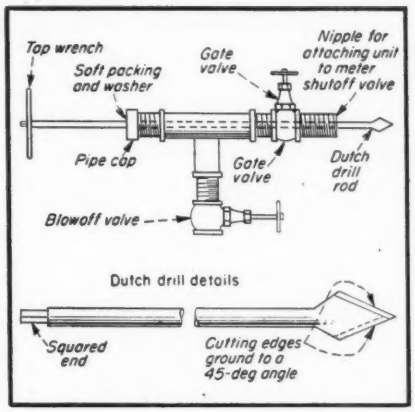
At 10 ft from the lamp, we have the same total luminous flux, as at one-foot distance, but it is spread over $10 \times 10 = 100$ times the area. Consequently the luminous-flux density equals $88 \div 100 = 0.88$ foot-candle or 0.88 lumen per square foot. We therefore do not have to get very far away from an ordinary light source before the intensity drops to a low value.

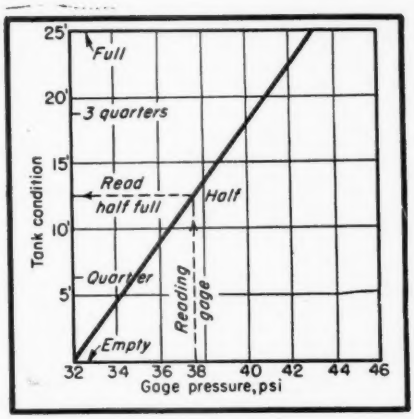
The next article will show how light from an electric lamp is concentrated into a beam, how this beam is manipulated to cause photoelectric tubes to perform many services.

POWER ENGINEERS' NOTEBOOK

PLANT-TESTED IDEAS TO SOLVE PROBLEMS OF DESIGN, OPERATION AND MAINTENANCE







Extra Valve Improves Maintenance Procedure

HYDRAULIC TURBINES served by single penstocks usually have butterfly valves at the spiral-casing inlet. Whenever the turbine is down for repairs, this valve shuts off the water without unwatering the penstock. Standard practice provides a bypass with a single shutoff valve around the butterfly valve. Before starting up the turbine this bypass permits filling the spiral casing with water, thereby equalizing the pressure on both sides of the butterfly wicket for greater ease in opening.

For an installation with 84-in. butterfly valves under 413-ft head with very long penstocks, it was realized that considerable advantage could be gained by providing duplicate guard valve in bypass. Extra gate valve, upstream of conventional gate valve, is normally open.

With both guard valve and butterfly valve closed, however, the regular bypass gate valve can be removed readily for inspection and repair. Without the guard valve, the regular valve could be removed only after unwatering the entire penstock, often leading to neglect of minor repairs.

EDWARD UEHLING *Milwaukee, Wis.*

Clean Out Nipples Without Shutting Down the Main

A NUMBER of our steam-flow meters were indicating incorrectly because the meter nipples in the steam main had scaled up. We designed the tool shown above, which has permitted reaming out these nipples without taking the steam main out of service. The unit is built around a $\frac{3}{8}$-in. tee. At one end of the straight run attach a short nipple with a cap drilled to accommodate the dutch-drill rod. At the back end of the cap place a soft ring of packing with a steel washer to prevent leakage. At the other end of the tee, attach the gate valve and nipples as shown. To the tee branch fix a nipple and blowoff valve.

Pull the drill back behind the gate valve and close both valves. Uncouple meter line from shutoff valve on meter nipple and attach unit. Open both gate and meter valves and operate drill rod with tap wrench or suitable tool. As reaming progresses the blowoff valve can be cracked to remove scale particles. All items are standard except the dutch drill, which can be made easily from any piece of standard drill rod.

E PODMAYER *Palisades Park, N. J.*

Read Tank-Water Level From Pressure Gage

HYDROSTATICS, when properly applied, can give a convenient means of indicating the water level of an elevated tank for water storage. At one plant a standard elevated tank was erected so that its bottom stood 75 ft above the ground. Its top was 100 ft above the ground.

On this installation an ordinary water-pressure gage was piped into the existing system and placed at the base of the tank. Then a curve chart was made up so the operator could tell tank level by pressure readings. Here is how it works.

When the tank was full, water level reached the top of the tank and hence stood 100 ft above the ground. Knowing that a pressure of 1.0 psi is required to support a column of water 2.31 ft high, all that need be done is to calculate the gage pressure for a 100-ft column, or 100 ft divided by 2.31 ft gives 43.31 psi—say 43. At the empty position, the gage pressure figures 75 divided by 2.31, and is 32.4 psi or 32.

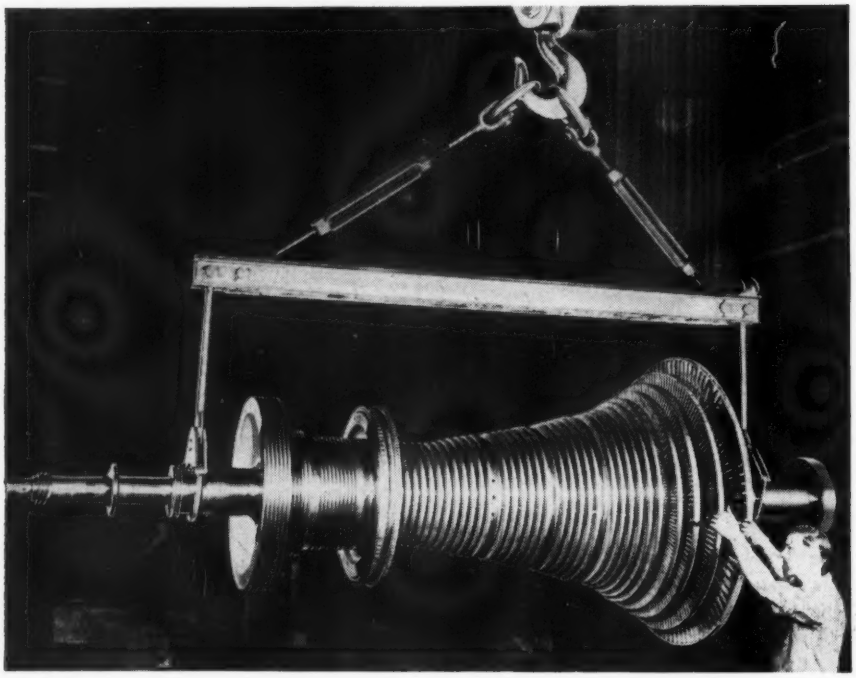
The curve chart that is shown above translates the pressure reading to the tank level. You can go still one step farther. With the total tank capacity known (10,000 gal) capacity per ft of a partially filled tank can be figured out. In this case 10,000 gal divided by 25 ft gives 400 gal per foot of tank.

J D CONSTANCE
Cliffside Park, N. J.

(*Continued on page* 110)

The Editors Invite Contributions

Here's your chance to cash in on one of those professional tricks you have used in your plant. POWER pays $20 for each item published here on problems in design, operation, maintenance. Your contribution need be in rough form only—just set down all facts with sketches in pencil. We will do any editing needed.



Lifting Rig Prevents Marring Turbine Spindle

A NEW LIFTING RIG devised by Allis Chalmers engineers prevents marring highly polished surfaces of bladed turbine spindles when they are being moved by overhead cranes. Metal straps are designed to fit snugly around the less vulnerable oil slinger portion of the turbine spindle. These straps are secured in place by removable pins, see photo.

The connection between the spindle and the lifting beam is rigid so as to reduce the possibility of damaging the spindle when removing it from or inserting it into the turbine casing. As shown in the photo, the rig consists of two channel sections suspended from the crane hook through two turnbuckle assemblies. The spindle is suspended from the channel sections through the rods and straps.

SHORTCUT TO MAKING PIPE ELBOW DEVELOPMENTS

AT BEST, laying out the development of a pipe bend is a long and tedious process. Where fitting of the pieces requires absolute accuracy the complete method of determination should be used. But in most cases, especially sheet metal work, an approximate method will do in view of allowances that must be made for seams and metal thickness. Here's how to do the job without mathematics, needing only a protractor, compass and straight edge.

Wrap a rectangular sheet of paper around a tube of the same size to be used for the elbow as in sketch 1. Trace top edge of paper on the sheet as shown. After unwrapping, cut off excess paper, which gives a pattern width equal to tube circumference.

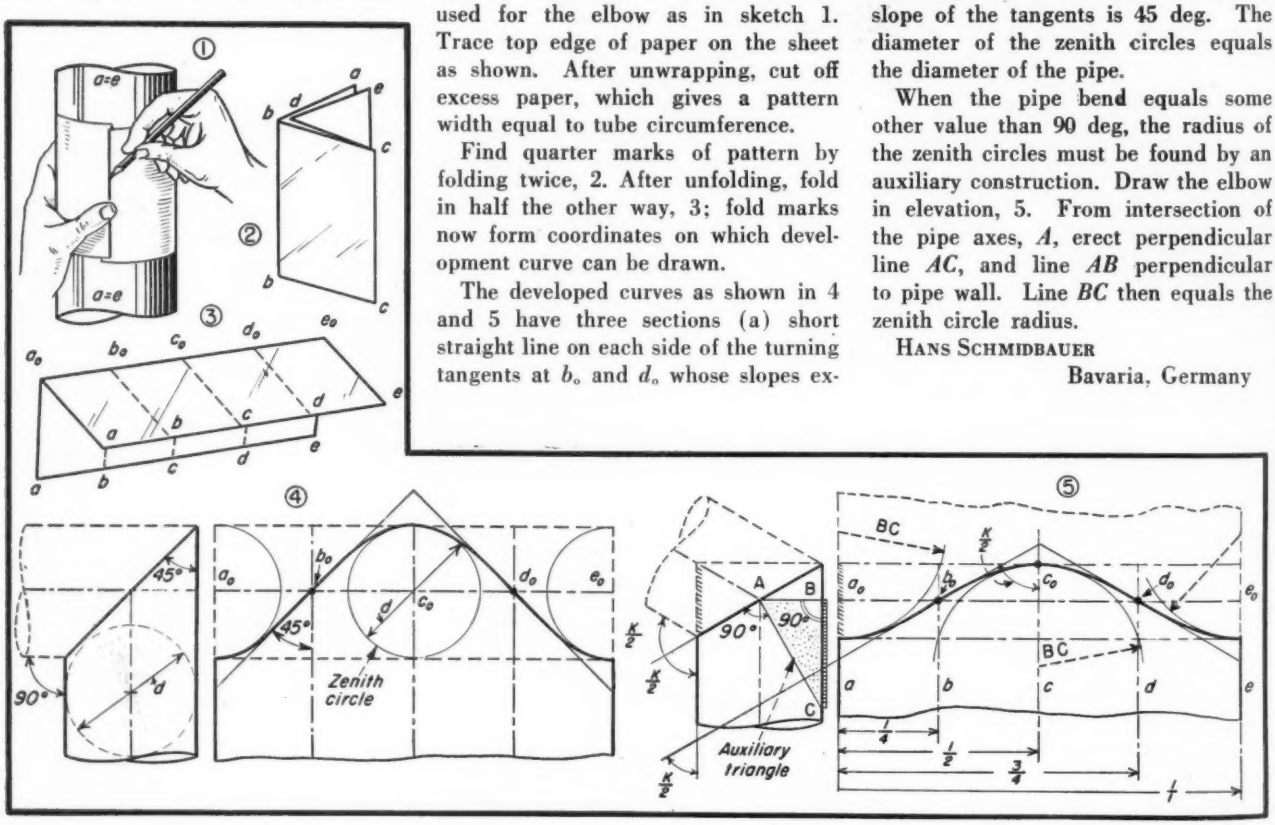
Find quarter marks of pattern by folding twice, 2. After unfolding, fold in half the other way, 3; fold marks now form coordinates on which development curve can be drawn.

The developed curves as shown in 4 and 5 have three sections (a) short straight line on each side of the turning tangents at b_o and d_o whose slopes exactly equal one-half the knee angle, (b) zenith circles, (c) line sections with relatively flat curvature, which can be drawn free hand or with the aid of french curves.

For the 90-deg elbow in sketch 4 the knee angle, k, is 90 deg and hence the slope of the tangents is 45 deg. The diameter of the zenith circles equals the diameter of the pipe.

When the pipe bend equals some other value than 90 deg, the radius of the zenith circles must be found by an auxiliary construction. Draw the elbow in elevation, 5. From intersection of the pipe axes, A, erect perpendicular line AC, and line AB perpendicular to pipe wall. Line BC then equals the zenith circle radius.

HANS SCHMIDBAUER
Bavaria, Germany



TEMPERATURE VARIATIONS, ABRASIVE SCALE NO PROBLEM WITH Edward BLOW-OFF VALVES

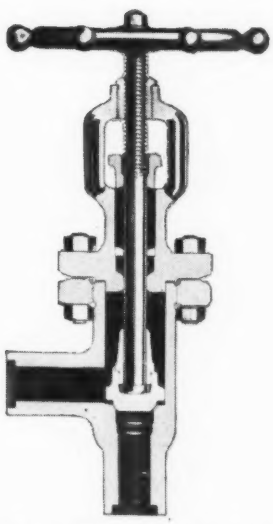
EASY OPERATION
Big knobbed handwheel, easy to grip even with oily hands.
LEAKPROOF BONNET
Welded integral or bolted, Edward blow-off bonnet joints won't leak.
PERFECT ALIGNMENT
Single set-up machining assures alignment of working parts.
ADJUSTMENT SIMPLE
Packing adjustment easy with through-bolted gland.
WEAR RESISTANT
Alloy seats and disks Stellite hard faced. (Stainless steel in lower pressures)
STREAMLINED
Nothing to prevent scale being blown completely through valve.
EQUALIZED CROSS-SECTIONS
No irregular masses of metal to distort on heating and cooling.

The vicious punishment of blow-off valve service—abrasive action of grit and scale—severe strains caused by violent temperature swings—finds its match in Edward blow-off valves.

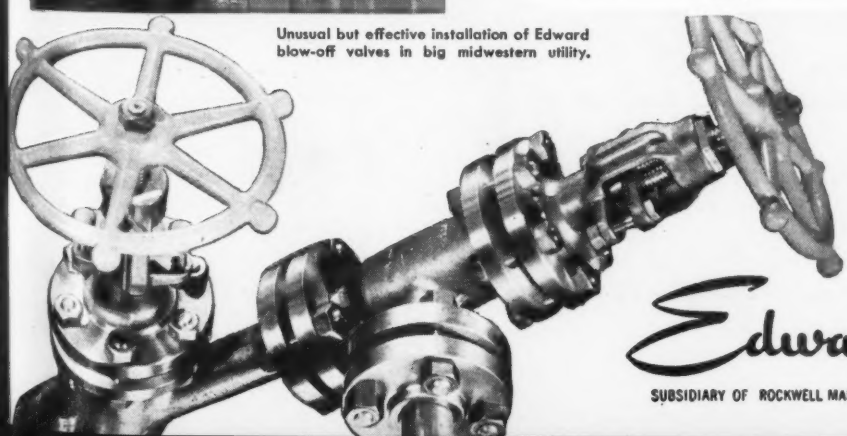
Special hard surfacing equipment, developed at Edward, prepares seats and disks for a long life of resistance to the grinding wear of sediment blown through the valve at high velocities.

Metal sections of Edward blow-off valve bodies are engineered to compensate for the thermal distortion so that a valve closed tight under high boiler temperatures is still tight after cooling.

LOW MAINTENANCE
PIPING FLEXIBILITY
SLOW OPENING
EASY REPACKING
TIGHT CLOSURE
LONG LIFE



Typical Edward angle bolted bonnet blow-off valve. Choice of straightway or angle designs gives maximum piping flexibility.



Unusual but effective installation of Edward blow-off valves in big midwestern utility.

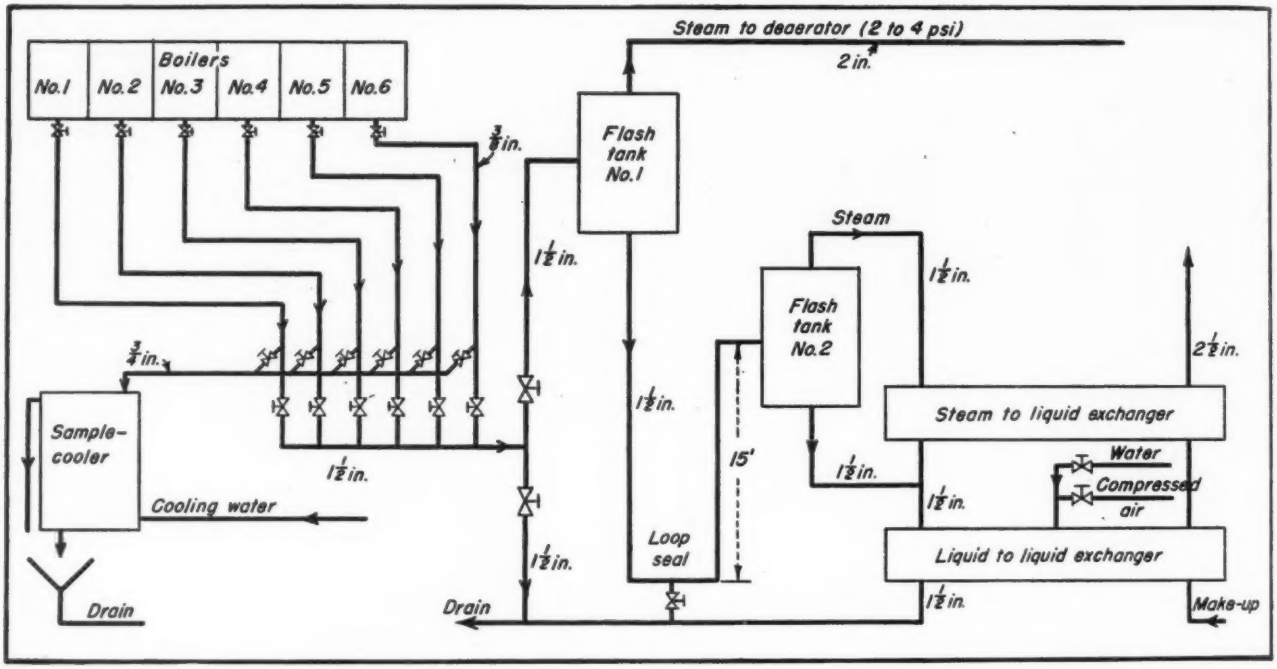
Edward builds blow-off valves for 150 lb to 2500 lb boiler service. Write for Catalog 12-D.

Edward Valves, Inc.

SUBSIDIARY OF ROCKWELL MANUFACTURING CO EAST CHICAGO, INDIANA

PROBLEMS FROM THE PLANT

Exercise your engineering wits by submitting answers to this question, fresh from the plant. Suitable material will be paid for; answers accompanied by sketches or photographs command additional pay



WHICH HEAT-SAVER SYSTEM IS MOST ECONOMICAL?

WE EVAPORATE an average of 750,000 lb of water daily from six boilers having 2690 sq ft of heating surface and operating at 135 psig with a 3% blowdown. Sketch shows a continuous blowdown heat-saver system that has been proposed for installation in our plant.

Our deaerating heater operates at 2 to 4 psi. Using an average of 3 psi, we could expect to flash about 15%, or 3375 lb of steam per day. This leaves 19,125 lb of blowdown per day for the second flash tank, which would probably flash about 1% from 3 psi to atmospheric pressure.

If the second flash tank and steam to the liquid heat exchanger were eliminated, heat in the 1% (or 191 lb) of steam would not be lost since it would pass through the liquid-to-liquid heat exchanger instead.

Will the slight increase in efficiency of the proposed system warrant the extra cost? I believe one flash tank and a liquid-to-liquid heat exchanger is the most economical system for us. Do POWER readers agree with me?—CH

Readers' Answers

How Can We Insulate and Waterproof Concrete Tank?

(This question is from May issue with best answers from readers.)

We plan building a hot-water tank to store water for our laundry. The tank, to be constructed of reinforced concrete, will be located underground. We intend to insulate and waterproof it.

A pump will be installed to pump water from the tank into a hot-water line that feeds the various laundry units. Pressure in this line is 50 psi. The pump will be required to lift a 10-ft static head. Normal water temperature varies between 180 and 190 F.

Can POWER *readers suggest methods of waterproofing and insulating the tank? What type pump is best suited for this application?—AW*

Install Bypass for Pump

AW SHOULD AVOID building an underground concrete tank if at all possible. If he must have such a tank I recommend the top of it be above ground with a manhole for inspection and cleaning. Tank floor should slope to a sump at one end, deep enough so pump can drain tank dry.

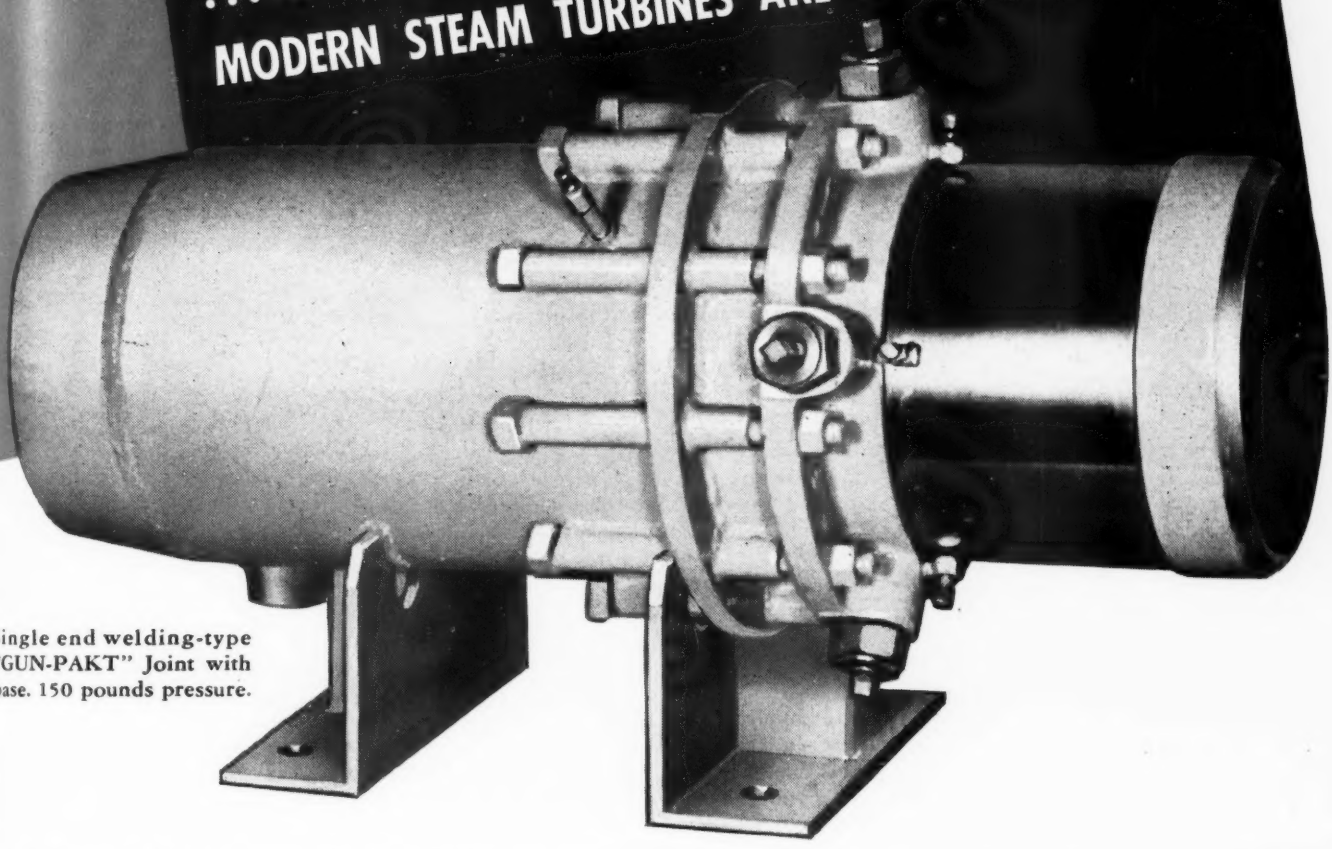
If it's lack of space that prompts *AW* to put tank underground, he may locate it on roof or elevated structure with the same result. In addition a positive head is maintained on the pump.

Fit pump with a bypass to shunt part of discharge water back to tank during periods of low water demand, preventing pump overheating. It would also be wise to install a float valve to control water level.—**H T Livingston, Los Angeles, Calif.**

(Continued on page 114)

GUN-PAKT EXPANSION JOINTS

...AS IMPORTANT TO STEAM DISTRIBUTION AS MODERN STEAM TURBINES ARE TO POWER PLANTS



Single end welding-type "GUN-PAKT" Joint with base. 150 pounds pressure.

The "GUN-PAKT" feature has been called the greatest expansion joint improvement of modern times.

It completely eliminates the need for costly shutdowns and heating interruptions while servicing the joints. "GUN-PAKT" Expansion Joints are repacked *under full steam pressure.* Insert a packing plug, twist a wrench, and the job is done. It's as simple as that. Special Alemite fittings provide for proper lubrication.

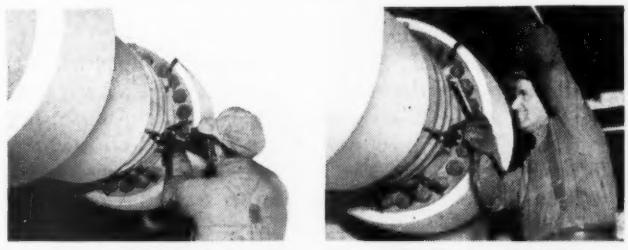
Maintenance costs are reduced too. One user spends 65 cents per year per joint. Another sets the figure at half that! Wherever steam is distributed, the "GUN-PAKT" Expansion Joint is the one they talk about—and specify!

FOR THE FULL "GUN-PAKT" STORY, GET YARWAY'S FREE BULLETIN EJ-1911. WRITE...

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.

Serviced

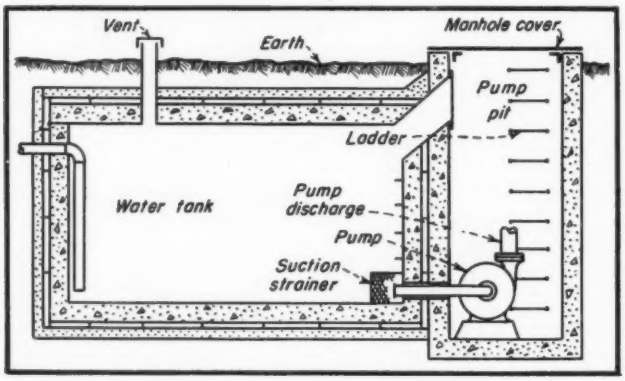
UNDER FULL STEAM PRESSURE

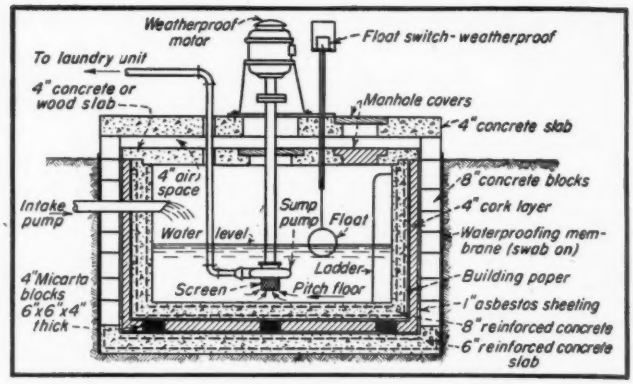


1. INSERT YARWAY PACKING **2. TWIST A WRENCH.**

THE JOINT'S TIGHT . . . THE JOB DONE

YARWAY GUN-PAKT EXPANSION JOINT





Insulate With Cork Slabs

HYDRAULIC INSTITUTE'S rule for locating boiler feed pumps recommends suction pressure be 14 ft more than vapor pressure of the liquid, plus a safety factor equal to the difference in vapor pressure caused by a 2% rise in water temperature. Using this rule, the positive-suction head should be 3.1 ft. This means *AW* must place the suction connection of the pump at least 3.1 ft below the expected low-water level in his tank regardless of pump type.

Waterproofing compounds may cause concrete to crack, resulting in leakage. A cement mortar properly mixed, poured and hardened is as waterproof as any mix containing special preparations for waterproofing. The cement mortar recommended consists of cement, sand and gravel in the ratio of 1:2:4 or 1:2½: 5 using 8 to 10 lb of hydrated lime to each sack of cement. Keep cement mortar warm during hardening and allow at least 10 days for mortar to set. Above sketch, left, shows general construction features for underground tank as well as adjacent pump pit.

A 2-in. cork-slab insulation is recommended. Additional water tightness of the tank is assured by application of membrane waterproofing to the cork-slab insulation in such a manner that a watertight envelope forms around insulation. This membrane consists of three plies of roofing felt. Each strip is laid in a bed of hot asphalt or pitch and overlaps the previously laid strip so three plies are formed. The floor is then covered with cork the same as the walls except that wooden skewers are not needed.

To keep the tank watertight, let all piping as far as possible pass through the tank top. Any piping through side of tank should be well sealed and flashed where it passes through the membrane waterproofing. If possible, apply a layer of mastic to outside of protective wall.—**Milton N Kraus, Long Island, N. Y.**

Sump Pump Recommended

FROM OUR EXPERIENCE *AW* should build his tank as in above sketch. The sump pump will always operate under flooded conditions, reducing cavitation hazards. It would be wise to build a corrugated steel shelter over the slab for protection during maintenance. The float switch may be used to sound an alarm should level in the tank rise above normal.—**J Constance, Cliffside Park, N. J.**

Install Steel Tank In Concrete Pit

AW IS HEADED FOR TROUBLE if he builds a concrete tank to store hot water at a temperature of 180-190 F. The concrete may develop cracks resulting in numerous leaks.

I suggest installation of a round horizontal steel tank encased in insulating concrete. A better job would be to set tank in a concrete pit with enough work room to apply blanket insulation.

Pumping is best handled by making the pit large enough to install a pump at end of tank. Hot water cannot be lifted on suction side of pump as in *AW's* sketch since water at 180-190 F would flash to vapor and the pump become steambound. At 180 F, 15 in. of the theoretical 30 in. (mercury) available for cold-water suction is lost, while at 190 deg F only 11 in. are available for suction lift. These are theoretical figures. not to be held to in an actual installation.

If supply water is introduced near tank top, heat losses will result in coolest water getting to pump first.—**Ira A Butcher, Piney River, Va.**

Two Ways to Waterproof

THERE ARE TWO METHODS of waterproofing *AW's* tank: (1) By using concrete of low porosity, a limited amount of mixing water, complete mixing, elimination of all joints, and by pouring bottom and sides in one continuous operation, he can readily obtain a waterproof tank. It should be kept from drying for at least a week after being poured. (2) He can use one of the many patented waterproofing compounds for concrete on the market. Most of these compounds, however, reduce concrete strength and so are not always desirable.

Tank may be insulated by using cinders, shavings or sawdust, placed between soil and tank walls. Insulation should be put in place before concrete is poured. Since the thermal conductivity of concrete is low. *AW* need not resort to expensive insulation.

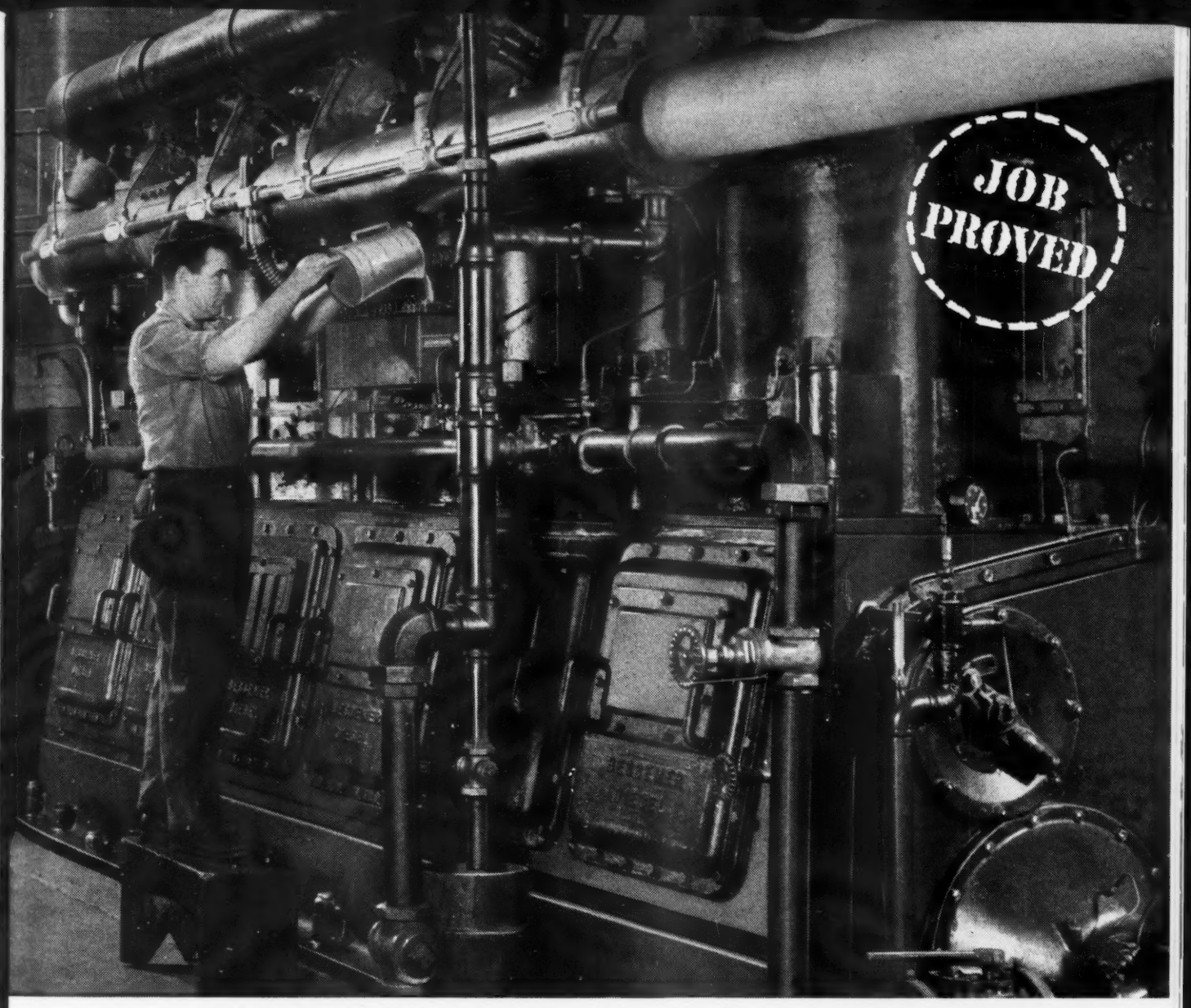
A standard centrifugal pump is generally not applicable for pumping 180-F water with the 10-ft suction head as in *AW's* sketch. Install pump in a pit alongside the tank. A positive-suction pressure should be maintained at pump inlet.—**Tyler G Hicks, New York City**

Insulate With Asphalt

TO WATERPROOF a concrete tank *AW* should pour floor and walls at one time. Underground construction is more expensive than an insulated steel tank above ground. If he has to make an underground installation a steel tank, generously coated with asphalt, will be cheaper and more satisfactory than concrete.

AW mentions lifting water at 180 to 190 F, ten feet from this tank and discharging it into a hot-water main at 50-lb pressure. As saturation pressure at 190 deg is about 9.33 lb and a 10-ft lift

(*Continued on page* 144)



4,200 HOURS' OPERATION—STILL SLUDGE-FREE

Sun Diesel Lubricating Oil Almost Good As New After Outlasting a Competitive Product 5 to 1

A prominent manufacturer uses 8-cylinder, 4-cycle diesels to generate power. Recently, at the suggestion of one of our engineers, a Sun diesel lubricating oil was tried in one of the units.

Results were impressive. Inspected after three months, the engine was found to be in the cleanest condition since installed. In tests run against competitive oils, one manufacturer's product sludged up in 600 hours. Yet the Sun oil was practically as good as new after 3,000 hours, showing but a slight increase in neutralization number. In further tests, the Sun oil ran 4,200 hours in six months' operation without a change; the engine remained clean and sludge-free, and showed no signs of wear.

On the basis of this performance, the plant has extended the use of Sun oil to other diesel units.

Here is just one example of the records being set by Sun "Job Proved" lubricants in all their wide applications. You can rely on Sun products to keep diesels, turbines, steam engines and other power equipment operating smoothly and with minimum maintenance. To get complete information call the nearest Sun Office. For Technical Bulletin "Lubrication of Diesel Engines," write Department P-8.

SUN OIL COMPANY · ***Philadelphia 3, Pa.***

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SUN PETROLEUM PRODUCTS

"JOB PROVED" IN EVERY INDUSTRY

SUNOCO

TECHNICAL BRIEFS

ENGINEERING DEVELOPMENTS HERE AND ABROAD DIGESTED FOR BUSY POWER MEN

REVIEWED IN THIS ISSUE

PIPING

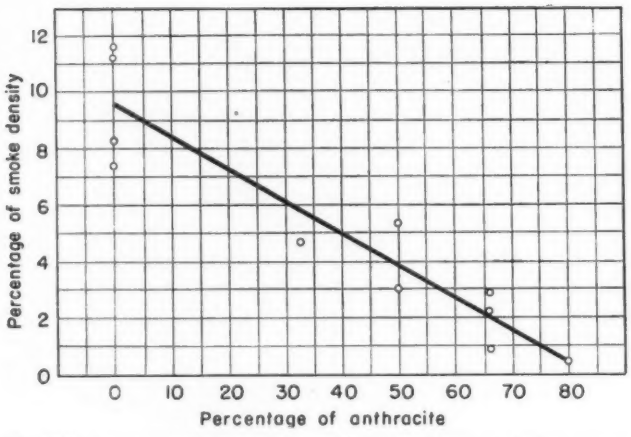
Some 1000-F Steam Pipe Materials
Further Investigation on the Graphitization of Piping

FUELS AND FIRING

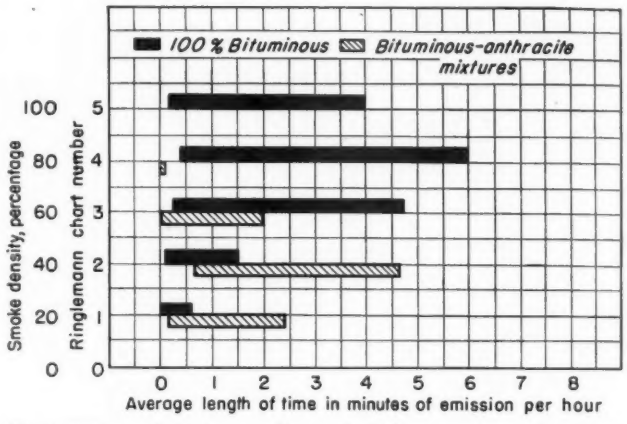
Anthracite's Part in Smoke Abatement
Burning of Anthracite in Power Plants
Pulverized Anthracite at Scranton Elec
Pulverized Coal Firing at Atmospheric and Elevated Pressures

HEATING

Heat-Pump Investigations for Chicago



1 Effect on average smoke production from a single retort stoker with different blends of anthracite and bituminous



2 Followup of 1 shows effect of different mixes on density and time of emission of the spasmodic outbursts of smoke

PIPING MATERIALS

Some 1000-F Steam Pipe Materials, *by Ernest L Robinson, General Electric Co.* This article presents a number of test results on materials suitable for high-temperature steam piping. Results are presented in a form suitable for guidance in design and as a basis of comparison between compositions under discussion. The author suggests comparing his results with those obtained elsewhere.

Material tested for long-time creep and rupture were molybdenum-vanadium in comparison with low chromium-molybdenum. Molybdenum-vanadium shows superior long-time strength at high temperature. Furthermore, long-time soaking of molybdenum-vanadium piping at high temperature has so far failed to show graphite formation.

Creep strengths are listed and plotted for a rate of 0.01% per 1000 hr and listed in tables for a rate of 0.001% per 1000 hr. Long-time rupture strengths are tabulated for 10,000 and 100,000 hr, but only the 100,000-hr strength is plotted in diagrams. *ASME Paper No. 47-A-74.*

Further Investigation on the Graphitization of Piping for the Edison Electric Institute and the Association of Edison Illuminating Companies, *by A M Hall and S L Hoyt, Battelle Memorial Institute.* Fundamental causes and the mechanism process of graphitization, measures taken to restore graphitized pipe joints, and the methods used to prevent graphite segregation at existing pipe joints have been summarized in previous reports before the ASME.

This report gives the results of further experience with some of the more resistant types of steel, as well as additional information on the insulation period of graphitization that can be worked into the previous reports.

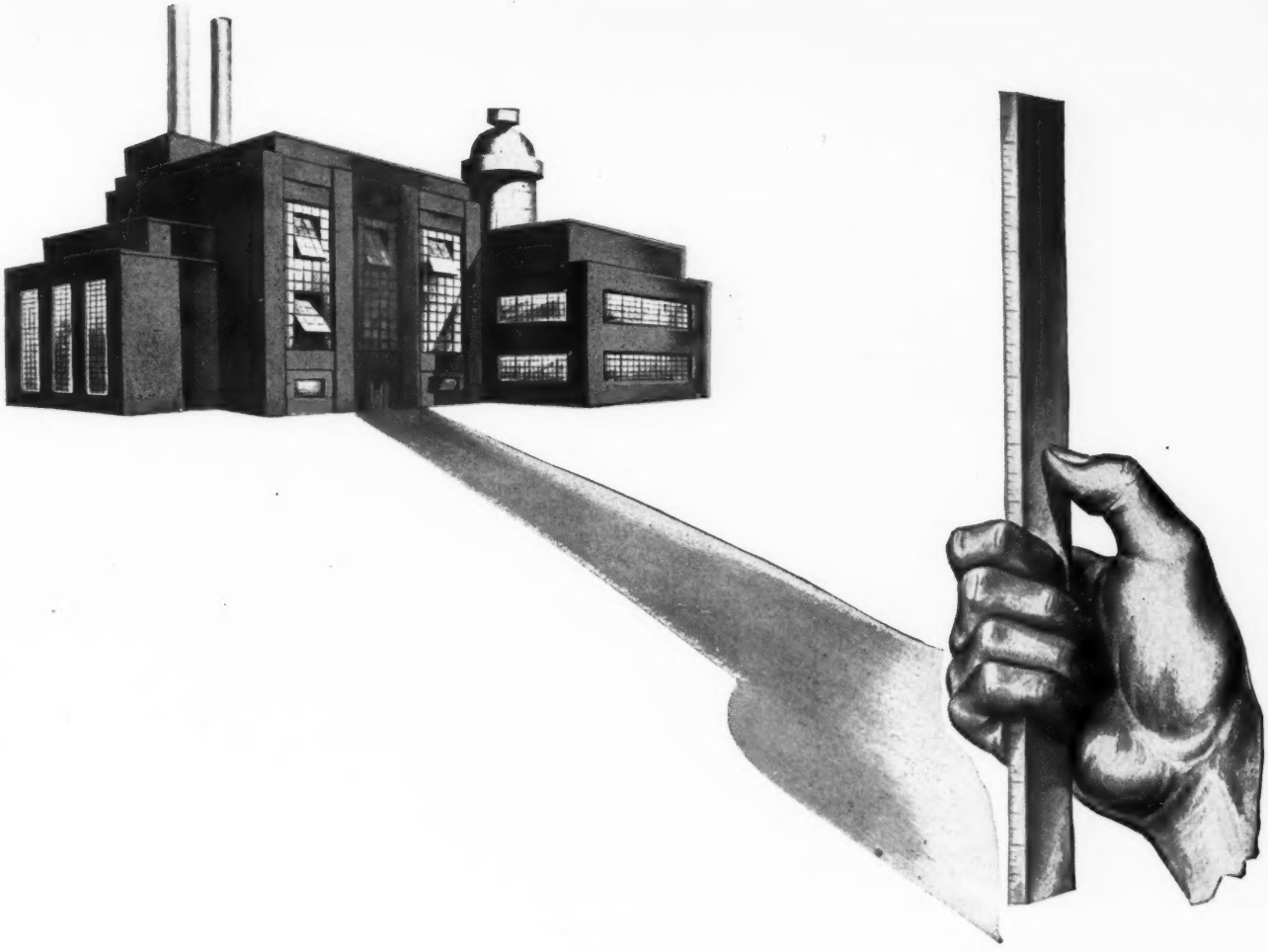
An effort was made to establish a relationship on a laboratory basis between graphitization on one hand and plastic deformation on the other. Deformation by stressing in tension was achieved. This is important because it bears on those special cases of severe segregated graphite formation not associated with welding but apparently related to deformation phenomena, such as Luders lines. *ASME Paper No. 47-A-139.*

FUELS AND FIRING

Anthracite's Part in Smoke Abatement, *by J F Barkley, U. S. Bureau of Mines.* First off, the author asks if the anthracite industry is pushing smoke abatement, and being represented when smoke-abatement problems and ordinances are discussed. If the industry is, then adequate publicity is not coming its way, he claims.

Meeting limitations on smoke or soot is of no particular concern to anthracite. It constitutes an inherently smokeless fuel. Its problems are more those of equipment and operation.

Anthracite can serve as an admixture where bituminous coal gives smoke because of (1) poor design and (2) poor operation. This applies particularly to underfeed stokers. Mixing finer anthracite sizes, like barley, with bituminous slack coal is practical and results in less smoke. This is done often enough so city ordinances can be met. During the war the efforts of the Bureau of Mines along fuel-conservation lines resulted in considerable experience with various mixtures of barley and bituminous. Fig. 1, 2 show the



How Well Does *Your* Boiler Plant Measure Up?

The effectiveness of your water conditioning can well be the yardstick of your boiler plant operation. How much *or how little* boiler water trouble you have is a true measure of successful, economical boiler plant operation. Consider then, "How well does *your* boiler plant measure up?"

Trouble-free operation is a result of scientific control.

W. H. & L. D. BETZ is an organization of engineers and chemists specializing in the solution of all industrial water problems. Years of experience have made Betz water conditioning service scientifically correct . . . complete . . . economical.

Our nationwide staff of engineers will welcome the opportunity of discussing with you this important subject of water conditioning . . . W. H. & L. D. BETZ, Gillingham and Worth Streets, Philadelphia 24, Pa. In Canada: Betz Laboratories, Limited, Montreal 1.

BETZ

BOILER WATER CONDITIONING • COOLING WATER CONDITIONING • INDUSTRIAL WASTE TREATMENT

effect in smoke production by different percentages of anthracite added to bituminous.

But in the field of dust limitations the anthracite user may have problems. Considerable flue dust can develop from firing fine sizes of anthracite with a forced-draft system. Very few papers give information on dust emission from equipment burning fine anthracite. C S Gladden's paper, "Cinder and Fly-ash Factors When Burning Small Anthracite Coal on Traveling-Grate Stokers" (ASME, 1946), represents about the best source for such data. Here is a point where the anthracite industry can investigate equipment designs for burning small-size anthracite and keep anthracite from becoming a source of dust-nuisance. *AC Paper No.* 3.

The Burning of Anthracite in Power Plants, *by R L Hallman, Pennsylvania Power & Light Co.* The unavailability and large price increase in No. 3 buckwheat has forced anthracite-burning utilities to change combustion-equipment design so it handles No. 4 and 5 buckwheat and silt.

Coal-handling problems increase considerably with these finer sizes of coal. Car shakeouts, slicers and rotary car dumpers, which must be used, add materially to costs. When these coals freeze to 3- or 4-in. thickness and above, some coal-thawing method has to be applied. In addition larger openings, gates and chutes up to 30 in. must be provided for coal movement. Bunkers, hoppers, chutes and spouts require a lining of stainless steel or a nonferrous material to give a smooth surface.

Firing-equipment design must also be revised to handle the smaller coal sizes. Since it is expensive to change stoker length, most operators increase stoker speed to get around one problem the fuel imposes. But this means more maintenance. Further changes must be made on individual area of air-admitting spaces to improve air-distribution and cut down on siftings.

The difficulties coal-producing companies have in preparing No. 3 and No. 4 buckwheat show up at the stoker. The fuel bed mats over as the moisture is driven off. Location and shape of furnace arches must be changed to give proper gas velocity and mixing.

With pulverized coal-fired units considerable erosion develops on fan-blading from entrainment of flyash and cinder in the gas streams. The author then goes into a discussion of the new Sunbury Station of the company planned for fairly early operation. *AC Paper No.* 7.

To Obtain Complete Text

Material in these briefs comes from one of three sources:

***Midwest Power Conference,* Tenth annual meeting, Chicago. April 7-9, 1948. Papers are identified by initials *MPC*. Available about August 1 in Volume X, Proceedings of Midwest Power Conference, 1948, $3, through Stanton E Winston, Conference Director, Illinois Institute of Technology, 3300 Federal St, Chicago 16.**

***American Society of Mechanical Engineers,* annual meeting, Atlantic City, N. J. Dec 1-5, 1947. Papers are identified by initials *ASME* and paper No. Available while supply lasts at ASME, 29 W 39th St, New York.**

***Anthracite Conference of Lehigh Univ,* Bethlehem, Pa. 6th annual meeting, Bethlehem, May 6-7, 1948. Papers are identified by initials *AC* and paper No. Available in the *Transactions* through A C Callen, conference chairman, Lehigh Univ, Bethlehem.**

The Pulverized Anthracite Installation at the Suburban Plant of the Scranton Electric Co, *by D D Schulz, Scranton Electric Co.* A steam-generating unit, guaranteed to produce from 180,000 to 310,000 lb of steam per hr at efficiencies ranging from 86.7% to 85.2%, is the first large high-pressure high-temperature direct-fired pulverized-anthracite unit to go into service. The coal will be No. 4 and No. 5 buckwheat. Steam will be delivered at 1350 psi and 1000 F to a 19-stage turbine-generator of 35,000-kw peak capacity. The author describes the major equipment and its function in this plant. *AC Paper No.* 8.

Experimental Combustion of Pulverized Coal at Atmospheric and Elevated Pressures, *by Battelle Memorial Institute: Herbert R Hazard and Fred D Buckley.* Combustion of pulverized coal at high heat-release rates under a wide range of static pressures constitutes one of the basic engineering problems in gas-turbine plant development. A study sponsored by the Locomotive Development Committee of Bituminous Coal Research, Inc set up four small air-cooled combustors to operate in connection with a small gas turbine.

To determine effect of pressure upon combustion a special furnace was employed. It had three sizes of burners operating from 2 to 75 psi and firing from 40 to 130 lb per hr of coal.

Burners were geometrically similar but dimensions differed to give equal burner-tip velocities for equal firing rates at design pressures of 2, 30 and 60 psi. Design called for a spinning, secondary air stream from the burners. Tests in the open showed effective coal and air mixing but no swirling action. These burners, accordingly, are to be considered as premixing units.

A high-volatile low-ash high-ash-fusion-temperature coal, Elkhorn No. 3, was used throughout all tests. It was fed to the furnace by a pressure hopper carrying about 700 lb of coal under furnace pressure, plus a few pounds for pressure drop through a ¾-in. piping and rubber-hose system.

A variable-speed feed screw moved the coal in the piping. Maintaining a uniform rate of feed proved difficult. A momentary decrease in furnace pressure developed a surge in coal, whereas an increase in furnace pressure pushed air back into the feed system, retarding coal flow.

All data obtained from pressure furnace operation indicate that combustion reactions are not affected appreciably by pressure, at least up to 75 psi. *ASME Paper No. 47-A-117.*

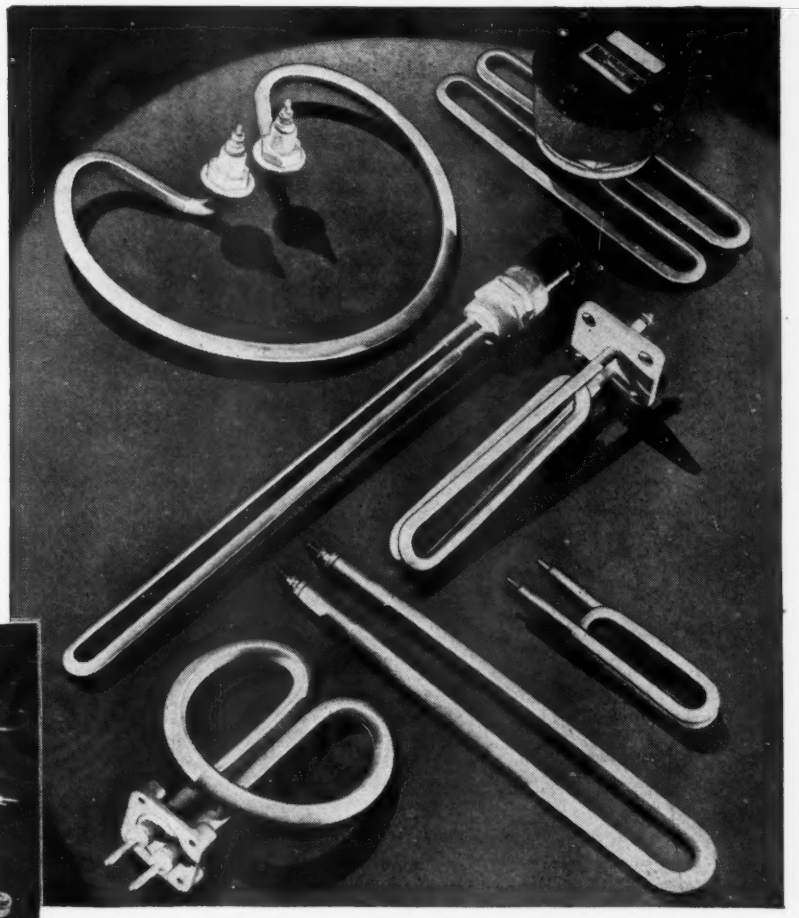
HEATING

Investigation of the Heat Pump for the Chicago Area, *by M S Oldacre, Utilities Research Commission.* Based on present knowledge, the heat pump can be considered in the Chicago area for only better than average homes, where cooling as well as electric-heating advantages are desired. Cost of equipment and operation cannot be the first consideration.

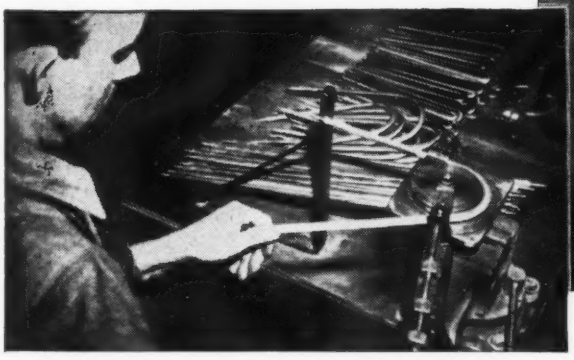
The heat pump can be used advantageously in many industrial installations for evaporating various products—milk, brine, pharmaceuticals—and for heating water. In evaporation one kwhr input to the heat pump may evaporate 20 to 50 lb of water depending on operating pressure and temperature.

One outstanding characteristic of the heat pump, seldom discussed in America, is its fuel-saving possibilities. For instance, a domestic coal-burning heating plant operates at about 50% efficiency. A system using electrical-resistance heating gets about 25% of the heat available in each lb of coal. A heat pump with a coefficient of performance of 4.0 could theoretically deliver the equivalent of 100% of the heat available in the coal at the generating station where the electricity is developed. *MPC Paper.*

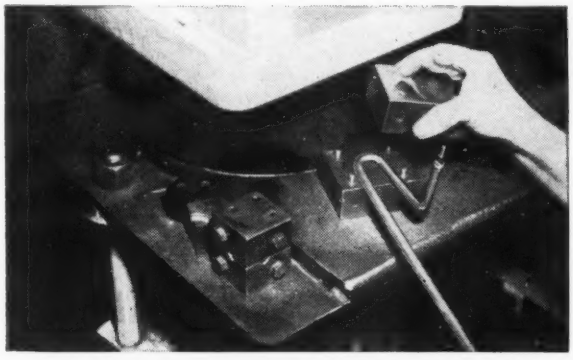
COPPER
means easier production, longer life, faster heat



The workability of copper simplifies production, while high heat transfer and corrosion-resistance add to performance of these Chromalox Immersion Heaters. Those shown here are for small vessels. Blade-type heaters are available for larger tanks, kettles and vats.



Straight tubes enclosing resistance wire and refractory insulation are bent to desired shape. Heat can be concentrated by increasing the number of bends in a given area.



Here the bends are die-pressed to maintain original high rock-hardness of the insulating material.

. . . in Chromalox Immersion Heaters

In their Chromalox Immersion-Type Industrial Heaters, the Edwin L. Wiegand Company of Pittsburgh, Pa. uses sheathing of Anaconda Copper Tube for applications where the utmost in high heat transfer and freedom from rust are essential.

In making these heaters, chrome-nickel resistance wire is imbedded in a special refractory and completely encased in straight tubes. Because of the ductility of the annealed copper tubes, intricate bends and offsets are then easily made, and the round elements compacted into triangular cross section under pressure of 20 tons p.s.i. to assure thorough compactness.

There's no end to the utility of copper tubes for industrial applications. Whether for heat exchange use, for fuel and water lines or large diameter process piping, copper offers standout advantages. You'll find commonly used sizes in stock at your nearest Anaconda Distributor.

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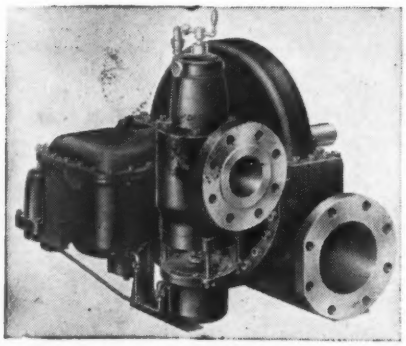
NEW PLANT EQUIPMENT



Mechanical-Drive Turbine E222

TYPE DP is a new small mechanical-drive turbine with ratings ranging from 10 to 1200 hp and speeds from 1000 to 5000 rpm. Available in three single-stage frame sizes with a 16 in., 20 in. and 25 in. wheel, Type *DP* embodies such features of large turbines as hydraulic governing for wider speed range and more accurate control and pressure oiling of bearings. It can be applied as a drive for pumps, compressors, fans, blowers, etc.

The new oil-relayed governing system gives superior performance, according to maker. Range of speed adjustment has been increased to 30%; speed regulation has been reduced to 6%. More parts are inclosed and governing system is completely incased in an oil atmosphere. A new balanced valve design is used for the governing valve and combined trip-throttle valve. With this design less force is required to operate valves and a given size valve can handle larger steam flows. These valves are combined in one assembly.

Maintenance is made easier by accessibility of individual components, such as the oil cooler, oil pump, and steam and oil strainers. The great majority of parts are interchangeable on all Type *DP* frame sizes. Spare parts kits, with parts applicable to these standard turbines, are available. **General Electric Co, Schenectady 5, N. Y.**

Medium Power Relay E223

A SMALL, LIGHT, single-pole type *AS* relay is suitable for control circuits. Having a normal power rating of one watt, this relay is available for service in ac and dc circuits. Its contact rating is 5 amp at 24 v, dc, or 110 v, ac.

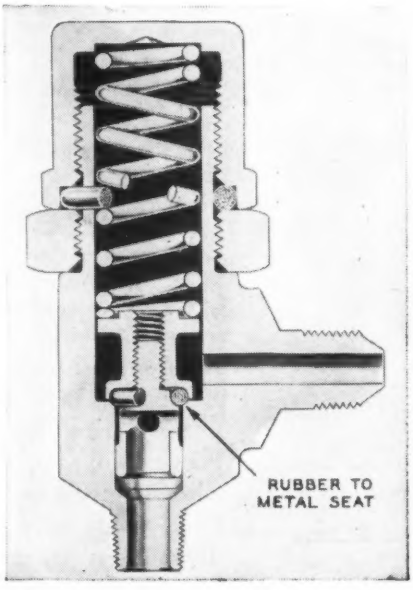
The relay's length is $1\frac{5}{8}$ in., height $1\frac{13}{16}$ in., width 15/16 in. Weight is 50 grams. Contact arrangements include normally closed, normally open, or double throw. **Allied Control Co, 2 East End Ave, New York 21, N. Y.**

Thermal Demand Meters E224

BUILT INTO THE SAME CASE with standard watt-hour meters, the new thermal ampere-demand meters provide low-cost, compact units that can be used by utilities on single-phase or polyphase systems for certain industrial and commercial installations where kva demands are incorporated into the rating. They are not intended for larger industrial metering.

Ampere demand is measured in these meters by heating of a bi-metallic element with current-carrying heaters. The readings may be converted to kva demand by multiplying by a constant assumed voltage. The low initial and maintenance cost of such devices permits application to smaller loads than can be justified with the more elaborate mechanical integrating devices.

Five types are available, making the meter suitable for single-phase; 3-phase, 3-wire service; for networks consisting of two phases and neutral of a 3-phase, 4-wire service; for 3-phase, 4-wire delta service; and for 3-phase, 4-wire wye service. **Westinghouse Electric Corp, P O Box 868, Pittsburgh 30, Pa.**



Relief Valves E225

HYDRAULIC and pneumatic relief valves are available in five pressure ranges, from 0 to 450 psi, and can be easily set by external adjustment to any operating pressure in the particular range involved. Body and cap elements are available in aluminum or brass, while stems and metal-seat pistons are made of stainless steel. The rubber-seat piston is of brass. The full series of pressure ranges are available in each of six basic sizes from $\frac{1}{4}$ to $\frac{3}{4}$ in. Sizes 1 in. and larger, as well as pressure settings up to 1000 psi, are obtainable on special order. Shutoff-piston is guided, making for quick unloading and smooth, silent operation. In the hydraulic model, the piston makes a metal-to-metal seat in the body. Another style has an O-ring rubber-to-metal seat for a positive seal where air and gas are used. **Parker Appliance Co, 17325 Euclid Ave, Cleveland, Ohio.**

Panel Instruments E226

DESIGNATED AS Type *DO*-71, the new line of $3\frac{1}{2}$-in. panel instruments are suitable in radio, power supplies, transmitters, amplifiers and aircraft. Accurate readings are assured by elimination of arc lines and distracting printing from the scale, in addition to use of a lance-type pointer.

High-strength *Alnico* magnets provide high torque, resulting in quick response and good damping of meter. The high torque allows use of larger-radius pivots, resulting in increased resistance to shock and vibration. Internal-pivot construction of the new instrument materially reduces their depth behind the panel, making them suitable for use in apparatus in which compactness is essential. **General Electric Co. Schnectady 5, N. Y.**

Rotary Pressure Joint E227

TYPE S JOHNSON rotary pressure joint is designed to be self-supporting and requires no external piping support. It can be used to admit heating or cooling agents to rotating rolls, particularly where considerable lateral movement of the rolls is encountered. Joint is completely self-lubricating, has no packing of any sort, and adjusts itself automatically for varying pressures. A spherical sealing surface maintains an effective seal, even though wear should occur at this point. A large bearing or guard of carbon graphite supports the entire weight of the joint and is accurately

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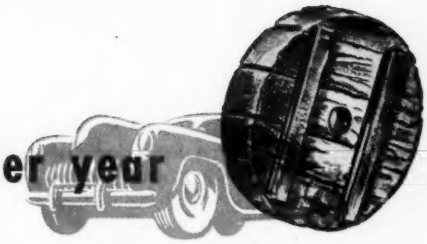

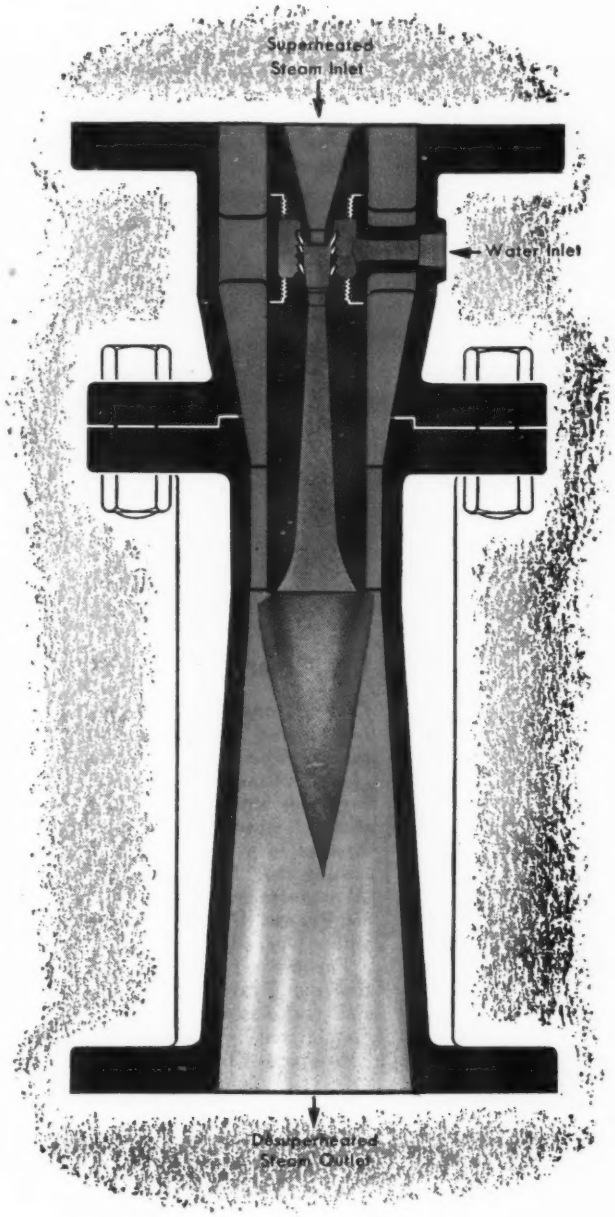

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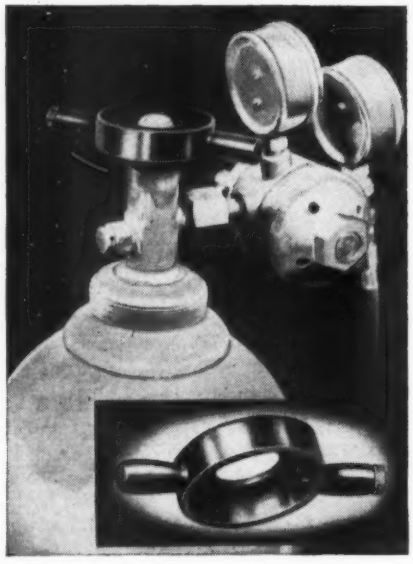
fitted inside the body where it provides a bearing surface on the rotating nipple.

The seal proper is effected between the hemispherical collar on the nipple and another carbon graphite bearing ring. Pressure acts as the sealing force. Standard construction has cast-iron head and body with steel nipple, but is also available with bronze trim, that is, bronze body and nipple, or all bronze with stainless-steel spring. It may also be furnished to provide for siphon drainage pipe, to remove condensate through the same head that admits the steam. Four sizes are available—½, ¾, 1, and 1¼ in.—all suitable for 150-psi pressure, and temperatures to 400 F. **Johnson Corp, Three Rivers, Mich.**

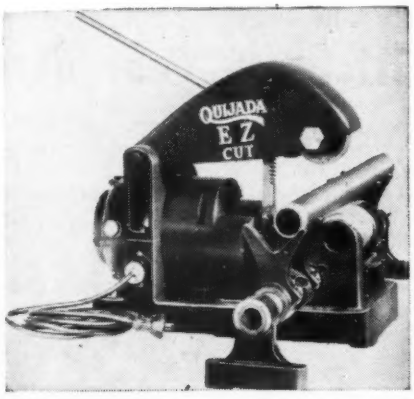


Cylinder Opener E228

ONE-PIECE CASTING fits over standard compressed-gas cylinder valve handle and is securely tightened in place by a knurled set screw. This *E-Z-Opener* turns tank valve without a wrench and also permits closing it much tighter with less likelihood of gas leakage. **Nutmeg Industries, 45 Deacon St, Bridgeport 7, Conn.**

Crane Control E229

A NEW PRINCIPLE of crane control eliminates mechanical load brake. Called *Magnetorque*, it provides hoisting smoothness and accuracy and is a simple unit through which braking forces are exerted magnetically. The hoist motor drives load both up and down but cannot be energized until magnetic unit is excited. There are no rotating electrical parts in the unit. Since braking forces are exerted magnetically, without friction and metal-to-metal contact, there is nothing to wear. There are no friction linings to replace or adjustments to be made. *Magnetorque* is also available with drum or full-magnetic control. It can also be furnished with all-position dynamic braking. **Crane Divisions, Harnischfeger Corp, 4400 W National Ave, Milwaukee 14, Wis.**



Pipe Cutter E230

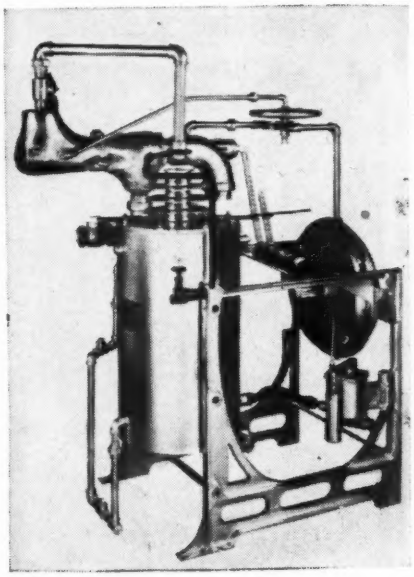
E-Z-CUT PIPE AND TUBE CUTTER features power driven rollers, automatic stop-start action and ball-bearing operation. It cuts tube and pipe sizes from ⅛ to 4 in. Cutting cast-iron pipe is also possible. Cutter wheel is easily removed for sharpening.

An integrally mounted ½ hp, 110 volt, universal motor furnishes direct gear drive to the rollers rather than to cutter wheel. Gears are self-lubricating. Automatic trip switch starts cutting operation when cutter wheel contacts pipe and automatically stops when the cut is finished. Cutter is furnished with 10 ft. of electric cord and twist-lock plug to motor. **Quijada Tool Co., 5474 Alhambra Ave, Los Angeles.**

Portable Emergency Light E231

WHEN THE REGULAR SOURCE of current fails, this portable self-contained emergency lighting system supplies instant light automatically from its own power. Each head lamp delivers about 100 watts and is capable of illuminating an area of about 10,000 sq ft for about five hours. The lamp heads are adjustable to any position and may be removed from the unit for installation on walls, stairways, etc.

When normal current is resumed, the lights automatically go out and a built-in charger restores power to battery for the next emergency. No special wiring is required to install this unit. It is only necessary to plug it into any convenient outlet in lighting circuit. The device is approved by the Underwriters Laboratories. **Electric Cord Co, 30 Church St, New York 7, New York.**



Gas Generator E232

CAST ALUMINUM GAS GENERATOR takes No. 1 fuel oil from a supply tank to a vaporizing chamber where oil vaporizes in the presence of a pilot flame. Vaporized oil leaves chamber and enters an ejector or mixing chamber where it is mixed with air and directed to a gas manifold for final combustion use. Four gallons of 138,000 Btu oil produces heat equivalent to 1000 cu ft of 550 Btu gas. Output gas is reported to burn with a blue, odorless and sootless flame.

Vapofier comes in eight sizes with capacities from ½ gal of fuel oil to 14 gal per hr. Each unit has a specific high and low generating range. **Vapofier Corp, 10316 S Throop St, Chicago 43, Ill.**

Voltage Regulator E233

THIS UNIT permits selective voltage stabilization of ac, dc, or rf outputs in any one circuit for wide variations of line and load. The ac output of the controller swings between 85 and 145 v, automatically adjusting output of the unit being controlled. By referencing this output back to the controller, regulation is achieved.

Controller provides stabilization at point

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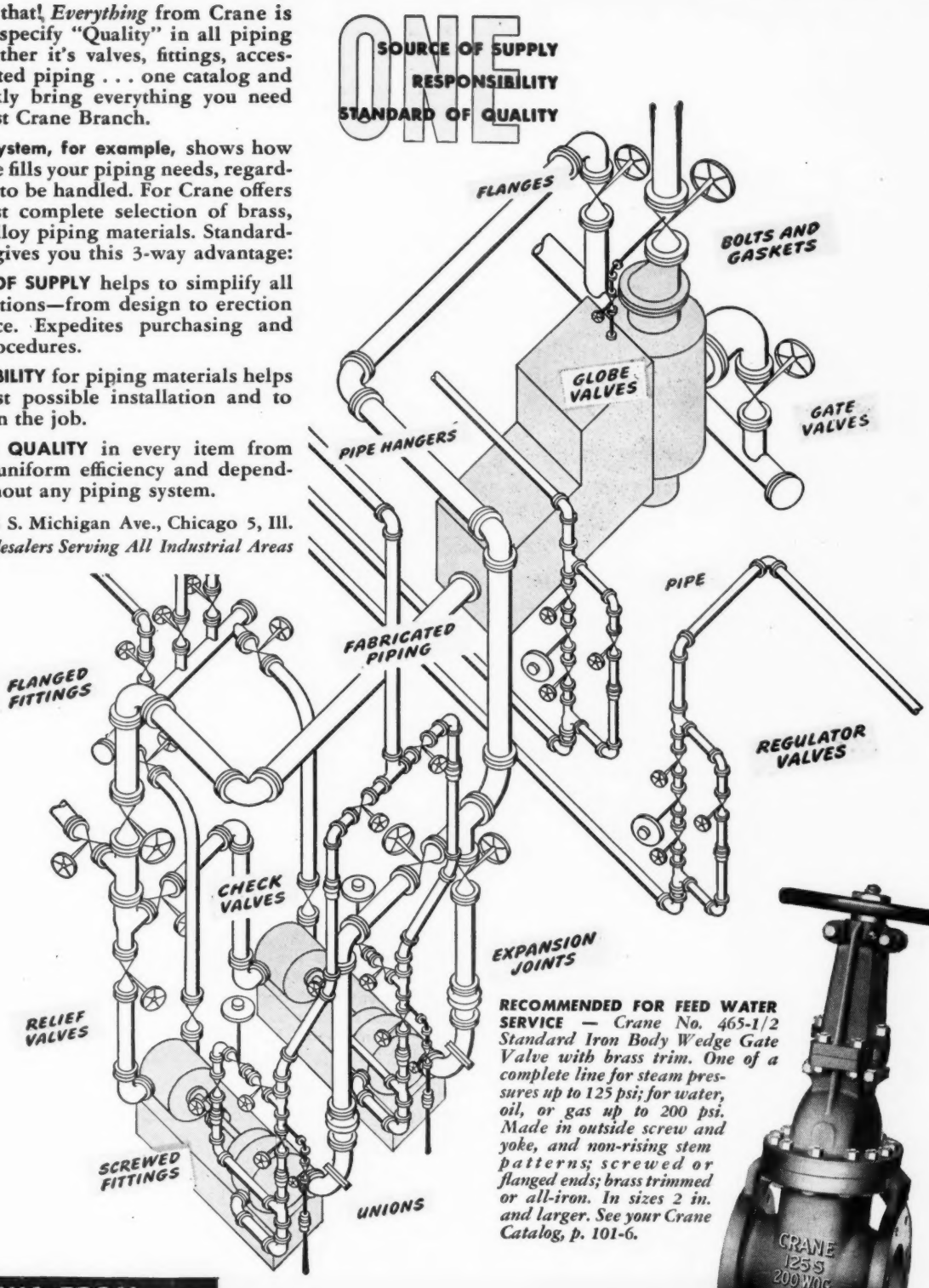
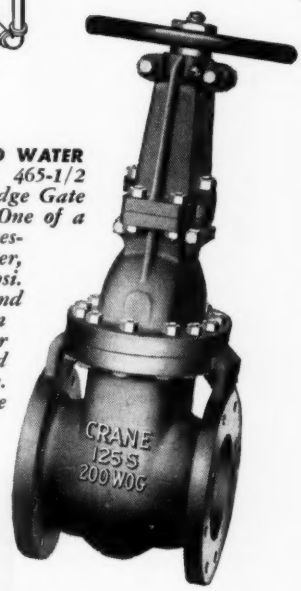


RECOMMENDED FOR FEED WATER SERVICE — *Crane No. 465-1/2 Standard Iron Body Wedge Gate Valve with brass trim. One of a complete line for steam pressures up to 125 psi; for water, oil, or gas up to 200 psi. Made in outside screw and yoke, and non-rising stem patterns; screwed or flanged ends; brass trimmed or all-iron. In sizes 2 in. and larger. See your Crane Catalog, p. 101-6.*



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requiring regulation. If stabilization is required for only one portion of a circuit, it can be done by referencing only that portion of the circuit back to controller. At least one watt of power must be made available to the controller bridge circuit. One controller unit may (1) stabilize the output of a transformer (2) regulate a generator field to control its output (3) selectively regulate a number of dc voltages and currents states the maker. The controller weighs about 100 lb and is available for relay rack mounting. It is protected against over-load and over-voltage. Normal input voltage range is from 95 to 125 v, ac, (50 or 60 cycles). **Sorensen & Co, Stamford, Conn.**

Electrode E234

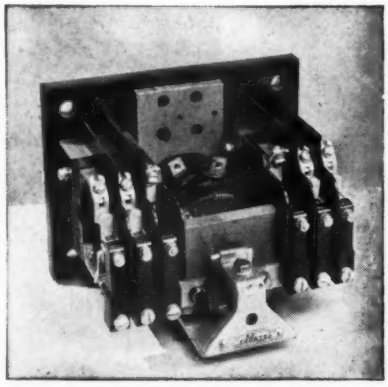
NICKEL-CORE, spatter-free electrode gives, its manufacturer claims, a perfect color match and a free machinability on cast iron welds. All-State No. 4 electrode, 3/32, 1/8 and 5/32 in. dia, can be used on either ac or dc in the 45-100 amp range. **All-State Welding Alloys Co, 96 West Post Rd. White Plains, N. Y.**

Motor Control Center E235

ANY NUMBER OF MOTORS rated up to 200 hp at 440 v may be controlled from this new motor control center. These control centers are so designed that all connections may be made from the front, permitting the centers to be lined against the wall or in back-to-back fashion.

Consisting of standard motor starter units that slide into vertical, cabinet-type sections, the motor control centers are assembled in "building block" fashion. The sections are 90 in. high, 20 in. wide, and 12 in. deep. Each starter is a complete, fully-enclosed unit and is available in five different sizes.

Power connections to the starters are made by "clothes-pin" contacts that grasp vertical buses in rear of sections where starters are slid into place. All wiring can be done from the front, without disturbing the starters. Each starter has a built-in circuit breaker for short-circuit protection. **General Electric Co, Schenectady 5, N. Y.**



Heavy Duty Relay E236

DESIGNED FOR OPERATION on circuits of 600 v and below, the heavy duty, rear connected, multi-pole dc magnet operated relay is available in 4, 6, 8, 10, 12 or 14 pole combinations.

All contacts are double break, silver to silver, and will carry 10 amp continuously at rated voltage. Salient feature of this relay is a fast dropout of the contact when coil is de-energized. The relay is available with contacts that operate all normally open or in combination with some contacts normally open and some normally closed.

The *AYB* relay is suitable for use on machine tools in steel mills and for other heavy-duty applications. The unit can be mounted easily on a control panel 2 in. thick or less. A mechanical interlock assembly is available for interlocking two relays side by side and on same horizontal center line. **Westinghouse Electric Corp, Pittsburgh 30, Pa.**

Extension Bar E237

RIGID, COLD-ROLLED STEEL serves as material for an extension bar on a circle burner. Extension permits cutting circles up to 60 in. dia with one bar alone, or still greater lengths with multiple bars.

An adapter is silver-soldered to the bar and cadmium-plated to prevent rust. An aluminum set screw with cut threads is set diagonally on the adapter to give a firmer hold. **Scientific Research Co, Box 278, 1618 N Vancouver Ave, Portland 12, Ore.**

Heavy Duty Oil E238

REFINED FROM 100% pure Pennsylvania crude, this oil is specially compounded for diesel and gasoline engines in heavy-duty service. Foaming is prevented even under severe temperature and operating extremes by chemical additives. Sludge and soot particles are kept in constant suspension so they drain off during oil changes.

Low pour point assures minimum drag and easy starting in coldest weather. High viscosity index results in less thinning out, even at high operating temperatures. This new fully detergent and dispersive oil is marketed under the trade name of *Colonel Drake* heavy-duty oil. **Pennsylvania Refining Co, Butler, Pa.**

Tinning Pencil E239

RUSTPROOFING METALS, regalvanizing spots, tinning bearings may be done quickly with a *Kromover* pencil, according to the manufacturer. All that needs to be done is to wipe off oil and dirt with a clean rag and apply pencil at 450 F with oxyacetylene, air-acetylene or city gas flame. Protective coating resists corrosion, and protects iron or steel on which it is applied. **All-State Welding Alloys Co, Inc, 96 West Post Road, White Plains, N. Y.**

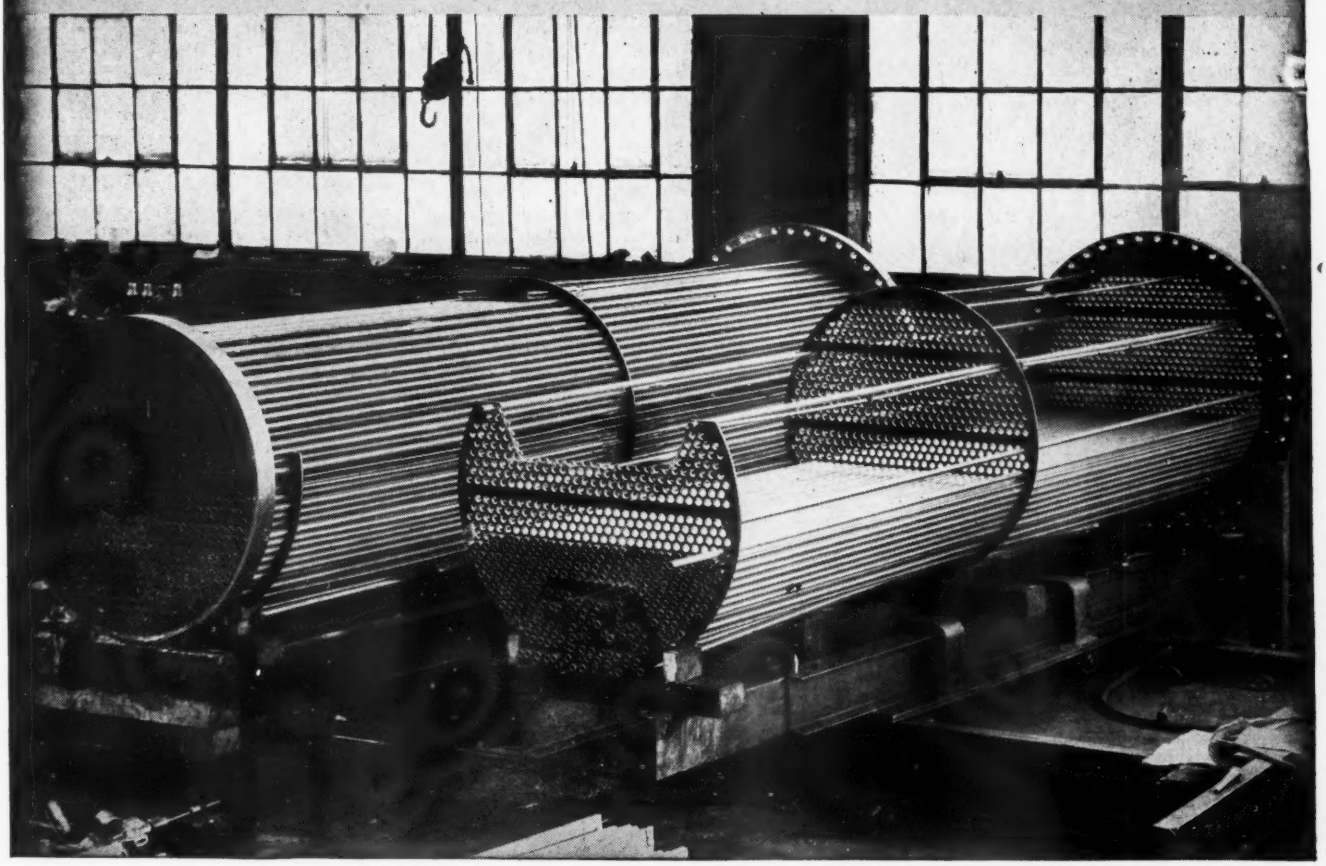
Time Lag Fuse E240

THIS FUSE FEATURES a long time lag that eliminates needless blowing on harmless overloads or starting motor current. The fuse meets every requirement for short-circuit protection. The thermal connection breaks the circuit when a temperature of 280 F is reached.

Both ends of the current-carrying copper fuse strip are alike to allow more accurate calibration as well as preventing unequal heating of end areas. The trigger spring, which also carries current, is a copper

Use convenient reply cards on page 162a to secure additional information on these new equipment items. Please be sure to identify your request with the new-equipment key letter, *E*, and number, as shown on the items above.

IT'S IMPORTANT TO KNOW ALL THE FACTORS AFFECTING CONDENSER TUBES



In selecting condenser tubes it is often the case that such conditions as temperatures, pressures, and compositions of the gases and fluids will be taken into account fully, only to have the tubes thus chosen give short service. In such cases, it is wise to call in Revere and ask for a thorough check of the situation before assuming that the wrong alloy was specified.

Here is a case in point. Admiralty tubes in a high stage condenser in a refinery were lasting only three or four months. In the effort to increase life, the sour gas had been treated, but as no improvement was experienced, the treatment was discontinued. The Revere Research report, made after laboratory investigation, stated that Admiralty metal was the correct alloy and its use should be continued, but that microscopic study of a failed tube showed definite and conclusive evidence of fatigue corrosion, probably due to vibration. A conference with the people at the plant revealed that the condenser vibrated considerably. Hence the obvious recommendations: cut down the vibration by better bracing, resume treatment of the gas, and continue to use Admiralty tubes. These recommendations were followed, and when last checked the new Admiralty tubes had been serving for eight months and were still going.

The Revere Technical Advisory Service is eager to serve all users of condenser tubes and plates through close collaboration in the study of difficult problems.

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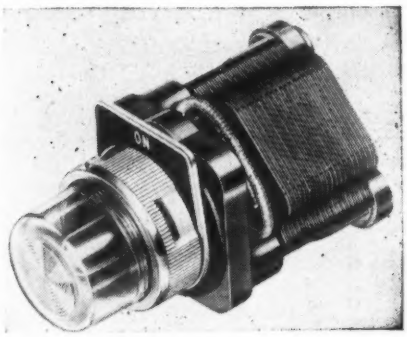
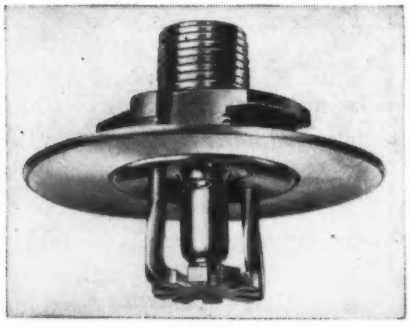
Equipment *Continued*

alloy having low resistance, retaining desired electrical and mechanical characteristics under all operating conditions. **Jefferson Electric Co, Bellwood, Ill.**



Oil-Tight Pilot Light E241

SUITABLE FOR machine tool applications where cutting oils and coolants may cause ordinary general purpose pilot lamps to fail, the pilot light is designed for panel mounting through a 1 7/32 in. dia hole. Construction permits mounting on panels 1/16 to ¼ in. thick. The unit is styled to augment a line of pushbuttons, selector switches, and selector pushbuttons previously introduced by the manufacturer. Color caps are available in clear, white, red, amber, green and blue, designed for wide angle visibility. The ac type has a built-in transformer permitting use of a 6-v incandescent lamp with a miniature, bayonet-type base. A 110-v candelabra screw base neon lamp is used in dc applications. **Square D Co, 4041 N Richards Street, Milwaukee 12, Wis.**



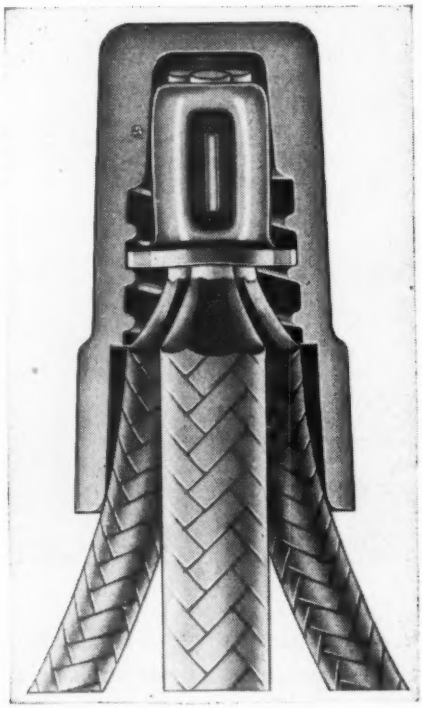
Ceiling Sprinkler E242

QUARTZOID CEILING SPRINKLER is fed by concealed piping and blends perfectly with decorative requirements of designers. Nothing but the deflector, supported by its arms, and the attractive Quartzoid bulb show below smooth level of ceiling. Temperature at the ceiling over a starting fire only has to reach 135 F to burst the *Quartzoid* bulb, release the water and begin extinguishing the fire. This is 30 F lower than the rating for conventional fusible sprinklers. **Grinnell Co, 260 W Exchange St, Providence, R. I.**

Manual Reset Timer E243

THIS DEVICE is operated by a heater element wound on a bi-metallic strip. When the heater element trips, contacts open and will not close until manually reset by a pushbutton. The unit can be set for any desired time delay before opening contacts.

The standard model has normally closed, heavy-duty, riveted contacts, mica and ceramic insulation, as well as cadmium-plated structural parts and brass rivets. Compact in design, each unit measures 3½x1¼x1⅛ in. The timer is rated 1500 watts, 115-230 v ac. Its timing range of 20 sec to 3 min makes it suitable for process control panels, standby power plants, etc. **George Ulanet Co, 414 Market St, Newark 5, N. J.**



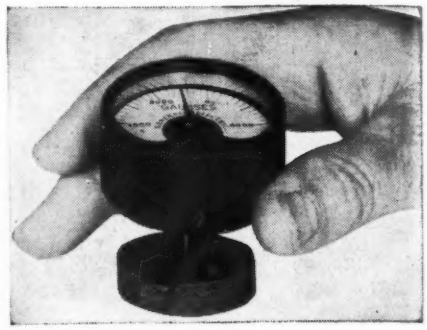
Solderless Wire Connector E244

PT-56 PIGTAIL CONNECTOR is approved by Underwriters Laboratories for use in both circuit and fixture wiring. Body of connector is made of tough bronze, electrotin plated. To assure that wires are fully inserted, both ends of the body are open for quick visual inspection. Excess wire is easily snipped off with the cutter on the manufacturer's standard tool. Once installed, the connector cannot loosen or drop off claims the manufacturer.

Maximum wire capacity of the joint is three No. 12 awg solid or stranded wires. Over 100 wire combinations can be used in same connector. **Thomas & Betts Co, Elizabeth 1, N. J.**

Coal Cleaner E245

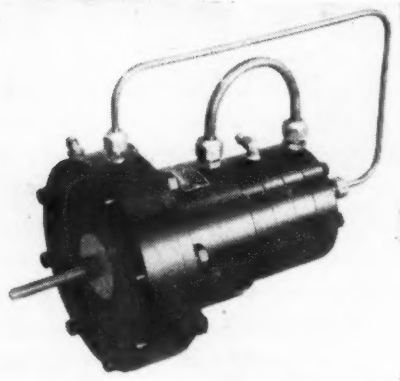
EASY-STARTING, coal cleaning system has a *Float-Sink* concentrator as the heart of the process. Separating medium is magnetite in a mixture of water, proportioned to give a desired separating gravity—range extends as low as 1.25 specific gravity. System can handle larger sizes of coal above the usual 6 in. range. **Link-Belt Co, 307 N Michigan Ave, Chicago 1, Ill.**



Gauss Meter E246

NEW MODEL gauss meter permits measurement of magnetic flux in many small-magnets of standard or irregular shape. The meter is a direct-reading instrument in a 2-in. round *Textolite* case. A hollow bronze exploring probe protrudes from back of the instrument. The concentric scale covers 260 deg and is graduated directly in gausses.

There is also available a triple meter kit conveniently combining three gauss meters of different ratings. The three meters are supplied in one carrying case and will fit those applications where several instruments of different ranges are required. **General Electric Co, Schenectady 5, New York.**



Positioner E247

PNEUMATICALLY OPERATED, precision positioner can accurately position a liner within a few thousandths of an inch over a range of 0 to 0.5 in. working directly from pneumatic pressure of 60 psi without mechanical

(*Continued on page* 148)

Use convenient reply cards on page 162a to secure additional information on these new equipment items. Please be sure to identify your request with the new-equipment key letter, *E*, and number, as shown on the items above.

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A

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How to plan a

SINGLE EFFECT EVAPORATOR USING A BAROMETRIC CONDENSER

Another in the series of basic Piping Layouts prepared by Jenkins Bros.

A typical single effect evaporator, or vacuum pan, used extensively in the food industries for concentrating dilute solutions—such as juice, soluble coffees, boullions and soups—is shown in this layout. Where cooling water is scarce, double and triple effect evaporators are used because of their higher efficiency, but the operation is basically the same.

Because high temperatures would destroy the product, excess water must be boiled off at low temperatures under a vacuum, generally produced by a barometric condenser. Low head room type condensers require a 15 to 20 foot tail pipe and a tail pipe pump to discharge the condensate and cooling water. Where head room is not a factor, a tail pipe at least 35 feet in length is used.

The tail pipe pump may be driven by electric motor, as shown, or by steam turbine. In either case the drive is automatically controlled to maintain a constant liquid level in the tail pipe. Where a turbine drive is installed it is quite common to use the turbine exhaust steam to feed the steam chest of the evaporator. In order to maintain high vacuum it is necessary to exhaust the air and other non-condensibles from the water, in a 2 stage steam jet air ejector.

The evaporator may be operated continuously, as shown, or as a batch process arrangement. In the continuous process the dilute solution is sucked into the evaporator through a liquid level control which maintains a constant level. The concentrated solution is drawn from the evaporator by a discharge pump which is regulated to deliver the product at the required concentration.

Jenkins PRACTICAL PIPING LAYOUTS

Illustrating the proved 3-point formula for trouble-free, time-defying hookups

A Use the right type valve for the service.
B Place valves correctly in the line.
C Choose Jenkins Valves for lifetime economy.

37

Fig. 47
Solid Wedge—Inside Screw Traveling Spindle BRONZE GATE VALVE 125 Pounds Steam 200 Pounds O.W.G.

Excellent where full, free flow is required. The traveling spindle indicates position of wedge and lifts it entirely clear of line of flow when valve is fully open.

To avoid corrosion and contamination, all valves in contact with the product being treated must be of selected metals, such as stainless steel or bronze, depending on local codes. Both types are listed in the valve recommendation table. Consultation with accredited piping engineers and contractors is recommended when adapting these suggestions to your own requirements, or when planning any major piping installation.

Copies of Layout No. 37 will be furnished on request. Just fill out and mail the coupon.

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SINGLE EFFECT EVAPORATOR USING A BAROMETRIC CONDENSER

VALVE RECOMMENDATIONS

For details and valves to suit varying conditions see Jenkins Catalog

Code	Quan.	Jenkins Valves	Service
A	1	Fig. 142—IBBM Globe	Control Cooling Water to Barometric Condenser
B	1	Fig. 106A—Bronze Globe	Control Cooling Water to Intercondenser
C	1	Fig. 47—Bronze Gate	Shutoff Intercondenser Discharge
D	1	Fig. 651—IBBM Gate	Shutoff Tail Pipe Pump Suction
E	1	Fig. 624—IBBM Sw. Check	Prevent Backflow to Tail Pipe Pump
F	1	Fig. 142—IBBM Globe	Tail Pipe Pump Discharge
G	2	Fig. 49—Bronze Gate	Pressure Reducing Valve Shutoff
H	1	Fig. 956—Bronze Globe	Manual Bypass of Press. Red. Valve
J	2	Fig. 976—Bronze Globe	Steam Supply Control to Ejectors
K	1	Fig. 49—Bronze Gate	Shutoff 2nd Stage Ejector Discharge
L	1	Fig. 47—Bronze Gate	Air Takeoff from Barometric Condenser
M	1	Fig. 741G—Bronze Needle	Pressure Gage Control
N	2	Fig. 47—Bronze Gate	Thermostatic Valve Shutoff
P	1	Fig. 976—Bronze Globe	Manual Bypass of Thermostatic Valve
R	2	Fig. 47—Bronze Gate	Steam Trap Shutoff
S	1	Fig. 92—Bronze Sw. Check	Prevent Condensate Backflow
T	1	Fig. 106A—Bronze Gate	Free Blow of Condensate
U	1	Fig. 106A—Bronze Gate	Trap Test
V	2	Fig. 47—Bronze Gate	Level Control Valve Shutoff
W	1	Fig. 106A—Bronze Globe	Manual Bypass
X	1	Fig. 92—Bronze Sw. Check	Pump Discharge
Y	1	Fig. 106A—Bronze Globe	Control Pump Discharge
Z	2	Fig. 741G—Bronze Needle	Pressure Gage Control
AA	1	Fig. 47—Bronze Gate	Pump Suction

Alternate Stainless Steel Valves			
Code	Quan.	Jenkins Valves	Service
V	2	Fig. 1300—Stainless Steel Gate	Level Control Valve Shutoff
W	1	Fig. 1308—Stainless Steel Globe	Manual Bypass
X	1	Fig. 1328—Stainless Steel Check	Pump Discharge
Y	1	Fig. 1308—Stainless Steel Globe	Control Pump Discharge
Z	2	Fig. 1308—Stainless Steel Globe	Pressure Gage Control
AA	1	Fig. 1300—Stainless Steel Gate	Pump Suction

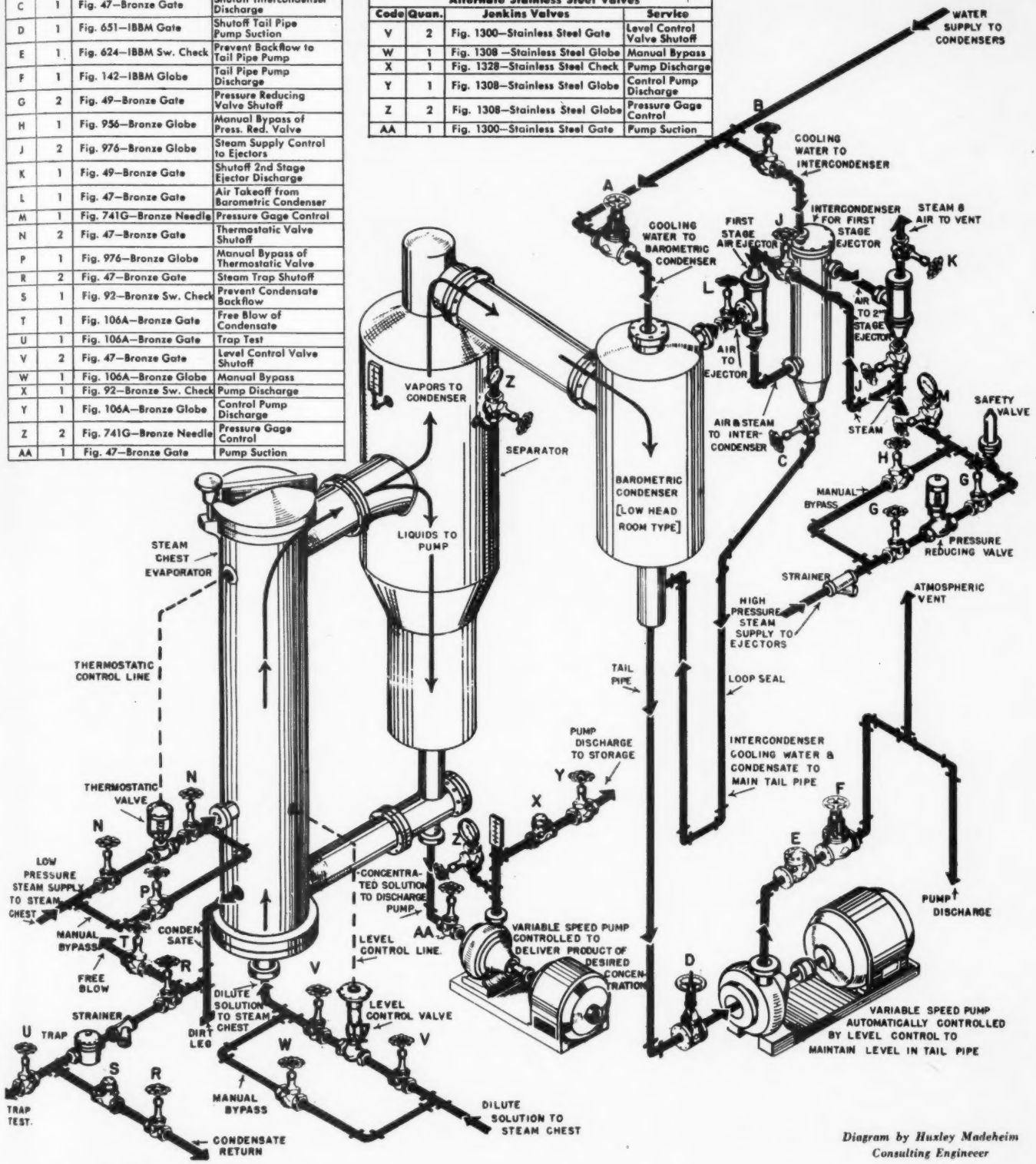

Diagram by Huxley Madeheim Consulting Engineeer

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DATA SHEETS

Number 193

Arc of Contact Factors

For Correcting Horsepower Ratings of Belts

When Arc of Contact on Small Pulley Is Less Than 180 Degrees

Procedure

To determine arc of contact correction factor for a flat drive: Subtract the diameter of the small pulley from the diameter of the large pulley. Then in column headed "Difference in Diameters," select the figure nearest to the difference obtained, and read across to the figure nearest to the given center distance. Correction factor (and arc of contact on the small pulley) will be found at the top of this column. Multiply the correction factor by the horsepower rating for the belt to obtain corrected horsepower.

Example: Standard Drive

Diameter of Driving Pulley 9.0". Diameter of Driven Pulley 43". Center distance 80". Difference in diameters = 43"—9" = 34". In the column headed "Difference in Diameters" find 34 and read across to 81.7 which is the figure nearest to the given center distance of 80". The correction factor of .94 (and arc of contact of 156 deg if required) is found at the top of column for standard drives. Multiply the correction factor by the horsepower rating for the belt to obtain corrected horsepower.

Courtesy of L H Gilmer Co, Tacony, Philadelphia, Pa.

Difference in diameters	ARC OF CONTACT—DEGREES																				
	90	100	110	120	123	125	128	131	134	137	140	143	146	150	153	156	160	164	168	172	176
	CORRECTION FACTOR FOR FLAT BELT DRIVES																				
	.67	.72	.77	.82	.83	.84	.85	.86	.87	.88	.89	.90	.91	.92	.93	.94	.95	.96	.97	.98	.99
1	0.6	0.7	0.8	1.0	1.0	1.0	1.1	1.2	1.2	1.3	1.4	1.5	1.7	1.9	2.1	2.4	2.8	3.5	4.7	7.1	14.3
2	1.3	1.5	1.7	2.0	2.0	2.1	2.2	2.4	2.5	2.7	2.9	3.1	3.4	3.8	4.2	4.8	5.7	7.1	9.5	14.3	28.6
3	2.0	2.2	2.5	3.0	3.1	3.2	3.4	3.6	3.8	4.0	4.3	4.7	5.1	5.7	6.4	7.2	8.6	10.7	14.3	21.5	42.9
4	2.6	3.0	3.4	4.0	4.1	4.3	4.5	4.8	5.1	5.4	5.8	6.3	6.8	7.7	8.5	9.6	11.5	14.3	19.1	28.6	57.3
5	3.3	3.7	4.2	5.0	5.2	5.4	5.7	6.0	6.3	6.8	7.3	7.8	8.5	9.6	10.7	12.0	14.3	17.9	23.9	35.8	71.6
6	4.0	4.5	5.1	6.0	6.2	6.4	6.8	7.2	7.6	8.1	8.7	9.4	10.2	11.5	12.8	14.4	17.2	21.5	28.6	43.0	85.9
7	4.6	5.2	5.9	7.0	7.3	7.5	7.9	8.4	8.9	9.5	10.2	11.0	11.9	13.5	14.9	16.8	20.1	25.1	33.4	50.1	100.2
8	5.3	6.0	6.8	8.0	8.3	8.6	9.1	9.6	10.2	10.9	11.6	12.6	13.6	15.4	17.1	19.2	23.0	28.7	38.2	57.3	114.6
9	6.0	6.7	7.6	9.0	9.4	9.7	10.2	10.8	11.5	12.2	13.1	14.1	15.3	17.3	19.2	21.6	25.9	32.3	43.0	64.5	128.9
10	6.6	7.5	8.5	10.0	10.4	10.8	11.4	12.0	12.7	13.6	14.6	15.7	17.1	19.3	21.4	24.0	28.7	35.9	47.8	71.6	143.2
11	7.3	8.2	9.4	11.0	11.5	11.9	12.5	13.2	14.0	15.0	16.0	17.3	18.8	21.2	23.5	26.4	31.6	39.5	52.6	78.8	157.5
12	8.0	9.0	10.5	12.0	12.5	12.9	13.6	14.4	15.3	16.3	17.5	18.9	20.5	23.1	25.7	28.8	34.5	43.1	57.3	86.0	171.9
13	8.6	9.7	11.1	13.0	13.6	14.0	14.8	15.6	16.6	17.7	19.0	20.4	22.2	25.1	27.8	31.2	37.4	46.7	62.1	93.1	186.2
14	9.3	10.5	11.9	14.0	14.6	15.1	15.9	16.8	17.9	19.1	20.4	22.0	23.9	27.0	29.9	33.6	40.3	50.2	66.9	100.3	200.5
15	10.0	11.2	12.8	15.0	15.7	16.2	17.1	18 0	19.1	20.4	21.9	23.6	25.6	28.9	32.1	36.0	43.1	53.8	71.7	107.5	214.9
16	10.6	12.0	13.6	16.0	16.7	17.3	18.2	19.2	20.4	21.8	23.3	25.2	27.3	30.9	34.2	38.4	46.0	57.4	76.5	114.6	229.2
17	11.3	12.7	14.5	17.0	17.8	18.4	19.3	20.4	21.7	23.1	24.8	26.7	29.0	32.8	36.4	40.8	48.9	61.0	81.3	121.8	243.5
18	12.0	13.5	15.3	18.0	18.8	19.4	20.5	21.7	23.0	24.5	26.3	28.3	30.7	34.7	38.5	43.2	51.8	64.6	86.0	129.0	257.8
19	12.6	14.2	16.2	19.0	19.9	20.5	21.6	22.9	24.3	25.9	27.7	29.9	32.4	36.7	40.6	45.6	54.7	68.2	90.8	136.1	272.2
20	13.3	15.0	17.1	20.0	20.9	21.6	22.8	24.1	25.5	27.2	29.2	31.5	34.2	38.6	42.8	48.0	57.5	71.8	95.6	143.3	286.5
21	14.0	15.8	17.9	21.0	22.0	22.7	23.9	25.3	26.8	28.6	30.6	33.0	35.9	40.5	44.9	50.5	60.4	75.4	100.4	150.5	300.8
22	14.6	16.5	18.8	22.0	23.0	23.8	25.0	26.5	28.1	30.0	32.1	34.6	37.6	42.4	47.1	52.9	63.3	79.0	105.2	157.6	315.1
23	15.3	17.3	19.6	23.0	24.1	24.9	26.2	27.7	29.4	31.3	33.6	36.2	39.3	44.4	49.2	55.3	66.2	82.6	110.0	164.8	329.5
24	16.0	18.0	20.5	24.0	25.1	25.9	27.3	28.9	30.7	32.7	35.0	37.8	41.0	46.3	51.4	57.7	69.1	86.2	114.7	172.0	343.8
25	16.6	18.8	21.3	25.0	26.1	27.0	28.5	30.1	31.9	34.1	36.5	39.3	42.7	48.2	53.5	60.1	71.9	89.8	119.5	179.1	358.1
26	17.3	19.5	22.2	26.0	27.2	28.1	29.6	31.3	33.2	35.4	38.0	40.9	44.4	50.2	55.6	62.5	74.8	93.4	124.3	186.3	372.5
27	18.0	20.1	23.0	27.0	28.2	29.2	30.7	32.5	34.5	36.8	39.4	42.5	46.1	52.1	57.8	64.9	77.7	97.0	129.1	193.5	386.8
28	18.6	21.0	23.9	28.0	29.3	30.3	31.9	33.7	35.8	38.2	40.9	44.1	47.8	54.0	59.9	67.3	80.6	100.5	133.9	200.6	401.1
29	19.3	21.8	24.7	29.0	30.3	31.4	33.0	34.9	37.1	39.5	42.3	45.6	49.5	56.0	62.1	69.7	83.5	104.1	138.7	207.8	415.4
30	20.0	22.5	25.6	30.0	31.4	32.4	34.2	36.1	38.3	40.9	43.8	47.2	51.3	57.9	64.2	72.1	86.3	107.7	143.4	215.0	429.8
31	20.6	23.3	25.6	31.0	32.4	33.5	35.3	37.3	39.6	42.2	45.3	48.8	53.0	59.8	66.3	74.5	89.2	111.3	148.2	222.1	444.1
32	21.3	24.0	27.3	32.0	33.5	34.6	36.4	38.5	40.9	43.6	46.7	50.4	54.7	61.8	68.5	76.9	92.1	114.9	153.0	229.3	458.4
33	22.0	24.8	28.2	33.0	34.5	35.7	37.6	39.7	42.2	45.0	48.2	52.0	56.4	63.7	70.6	79.3	95.0	118.5	157.8	236.5	472.7
34	22.6	25.5	29.0	34.0	35.6	36.8	38.7	40.9	43.5	46.3	49.7	53.5	58.1	65.6	72.8	81.7	97.8	122.1	162.6	243.6	487.1
35	23.3	26.3	29.9	35.0	36.6	37.8	39.9	42.1	44.7	47.7	51.1	55.1	59.8	67.6	74.9	84.1	100.7	125.7	167.4	250.8	501.4
36	24.0	27.0	30.7	36.0	37.7	38.9	41.0	43.4	46.0	49.1	52.6	56.7	61.5	69.5	77.1	86.5	103.6	129.3	172.1	258.0	515.7
37	24.6	27.8	31.6	37.0	38.7	40.0	42.2	44.6	47.3	50.4	54.0	58.3	63.2	71.4	79.2	88.9	106.5	132.9	176.9	265.1	530.0
38	25.3	28.5	32.4	38.0	39.8	41.1	43.3	45.8	48.6	51.8	55.5	59.8	64.9	73.4	81.3	91.3	109.4	136.5	181.7	272.3	544.4
39	26.0	29.3	33.3	39.0	40.8	42.2	44.4	47.0	49.9	53.2	57.0	61.4	66.6	75.3	83.5	93.7	112.2	140.1	186.5	279.5	558.7
40	26.6	30.1	34.2	40.0	41.9	43.3	45.6	48.2	51.1	54.5	58.4	63.0	68.4	77.2	85.6	96.1	115.1	143.7	191.3	286.6	573.0
41	27.3	30.8	35.0	41.0	42.9	44.3	46.7	49.4	52.4	55.9	59.9	64.6	70.1	79.2	87.8	98.6	118.0	147.3	196.1	293.8	587.4
42	28.0	31.5	35.9	42.0	44.0	45.4	47.9	50.6	53.7	57.3	61.3	66.1	71.8	81.1	89.9	101.0	120.9	150.8	200.8	301.0	601.7
43	28.6	32.3	36.7	43.0	45.0	46.5	49.0	51.8	55.0	58.6	62.8	67.7	73.5	83.0	92.0	103.4	123.8	154.4	205.6	308.1	616.0
44	29.3	33.0	37.6	44.0	46.1	47.6	50.1	53.0	56.3	60.0	64.3	69.3	75.2	84.9	94.2	105.8	126.6	158.0	210.4	315.3	630.3
45	30.0	33.8	38.4	45.0	47.1	48.7	51.3	54.2	57.5	61.3	65.7	70.9	76.9	86.9	96.3	108.2	129.5	161.6	215.2	322.5	644.7
46	30.6	34.6	39.3	46.0	48.2	49.8	52.4	55.4	58.8	62.7	67.2	72,4	78.6	88.8	98.5	110.6	132.4	165.2	220.0	329.7	659.0
47	31.3	35.3	40.2	47.0	49.2	50.8	53.6	56.6	60.1	64.1	68.7	74.0	80.3	90.7	100.6	113.0	135.3	168.8	224.8	336.8	673,3
48	32.0	36.0	41.0	48.0	50.2	51.9	54.7	57.8	61.4	65.4	70.1	75.6	82.0	92.7	102.8	115.4	138.2	172.4	229.5	344.0	687.6
49	32.6	36.8	41.8	49.0	51.3	53.0	55.8	59.0	62.7	66.8	71.6	77.2	83.7	94.6	104.9	117.8	141.0	176.0	234.3	351.2	702.0
50	33.3	37.6	42.7	50.0	52.3	54.1	57.0	60.2	63.9	68.2	73.0	78.7	85.5	96.5	107.0	120.2	143.9	179.6	239.1	358.3	716.3
51	34.0	38.3	43.6	51.0	53.4	55.2	58.1	61.4	65 2	69.5	74.5	80.3	87.2	98.5	109.2	122.6	146.8	183.2	243.9	365.5	730.6
52	34.6	39.5	44.4	52.0	54.4	56.3	59.3	62.6	66.5	70.9	76.0	81.9	88.9	100.4	111.3	125.0	149.7	186.8	248.7	372.7	745.0
53	35.3	39.8	45 2	53.0	55.5	57.3	60.4	63.9	67.8	72.3	77.4	83.5	90.6	102.3	113.5	127.4	152.6	190.4	253.5	379.8	759.3
54	36.0	40.6	46.2	54.0	56.5	58.4	61.5	65.1	69.1	73.6	78.9	85.0	92.3	104.3	115.6	129.8	155.4	194.0	258.2	387.0	773.6
55	36.6	41.3	47.0	55.0	57.6	59.5	62.7	66.3	70.3	75.0	80.4	86.6	94.0	106.2	117.7	132.2	158.3	197.5	263.0	394.2	787.9
56	37.3	42.1	47.8	56.0	58.6	60.6	63.8	67.5	71.6	76.4	81.8	88.2	95.7	108.1	119.9	134.6	161.2	201.1	267.8	401.3	802.3
57	38.0	42.8	48.7	57.0	59.7	61.7	65.0	68.7	72.9	77.7	83.3	89.8	97.4	110.1	122.0	137.0	164.1	204.7	272.6	408.5	816.6
58	38.6	43.6	49.6	58.0	60.7	62.8	66.1	69.9	74.2	79.1	84.7	91.3	99.1	112.0	124.2	139.4	167.0	208.3	277.4	415.7	830.9
59	39.3	44.3	50.3	59.0	61.8	63.8	67.2	71.1	75.5	80.4	86.2	92.9	100.9	113.9	126.3	141.8	169.8	211.9	282.2	422.8	845.2
60	40.0	45.0	51.3	60.0	62.8	64.9	68.4	72.3	76.7	81.8	87.7	94.5	102.6	115.9	128.5	144.2	172.7	215.5	286.9	430.0	859.6
64	42.7	48.1	54.7	64.0	67.0	69.2	72.9	77.1	81.9	87.3	93.5	100.8	109.4	123.6	137.0	153.9	184.2	229.9	306.1	458.7	916.9
68	45.3	51.2	58.1	68.0	71.2	73.6	77.5	81.9	87.0	92.7	99.4	107.1	116.2	131.3	145.6	163.5	195.7	244.3	325.2	487.3	974.2
72	48.0	54.1	61.5	72.0	75.4	77.9	82.1	86.8	92.1	98.2	105.2	113.4	123.1	139.0	154.2	173.1	207.3	258.6	344.3	516.0	1031.5
76	50.7	57.1	64.9	76.0	79.6	82.2	86.6	91.6	97.2	103.6	111.1	119.7	129.9	146.8	162.7	182.7	218.8	273.0	363.5	544.7	1088.8
80	53.3	60.0	68.3	80.0	83.9	86.6	91.2	96.4	102.3	109.1	116.9	126.0	136.8	154.5	171.3	192.3	230.3	287.4	382.6	573.3	1146.1
84	56.0	63.1	71.7	84.0	88.0	90.9	95.8	101.2	107.4	114.6	122.7	132.3	143.6	162.2	179.9	202.0	241.8	301.7	401.7	602.0	1203.4
88	58.6	66.2	75.2	88.0	92.2	95.2	100.3	106.1	112.6	120.0	128.6	138.6	150.4	169.9	188.4	211.6	253.3	316.1	420.9	630.7	1260.7
2	61.3	69.2	78.6	92.0	96.4	99.6	104.9	110.9	117.7	125.5	134.4	144.9	157.3	177.7	197.0	221.2	264.9	330.5	440.0	659.5	1318.0
96	63.9	72.2	82.0	96.0	100.5	103.9	109.4	115.7	122.8	130.9	140.3	151.2	164.1	185.4	205.6	230.8	276.4	344.8	459.1	688.0	1375.3
00	56.6	75.0	85.4	100.0	104.7	108.2	114.0	120.5	127.9	136.4	146.1	157.5	171.0	193.1	214.1	240.4	287.9	359.2	478.3	716.7	1432.7

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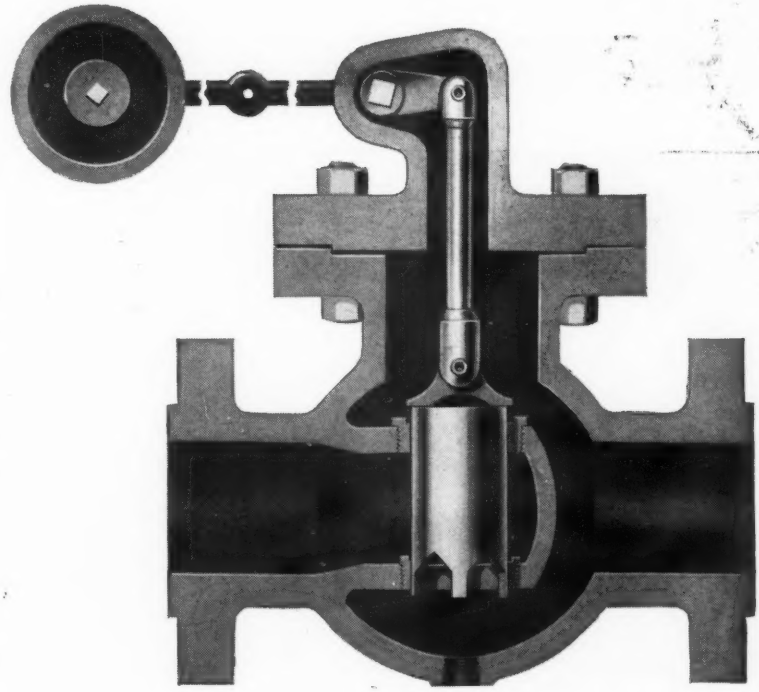
COPES BALANCED VALVES



A valve may be statically balanced while at rest, yet be so badly unbalanced dynamically—when handling flows under pressure—that inaccurate response to the actuating element causes a "hunting" action which makes impossible the desired precision of control. In COPES Valves, unbalanced forces are held within narrow limits over the entire operating range. This is why so many have been purchased *at a premium,* where control must be precise with actuation by float, solenoid or other element. Sizes: ¾-inch and up. When writing for data, give complete information on your operating needs.

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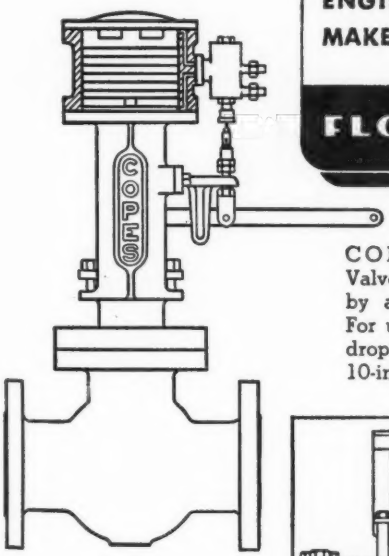
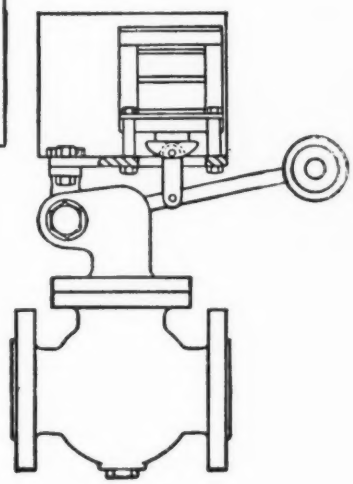
FLOWMATIC



COPES Type SLH Valve, relay operated by air, oil or water. For unlimited pressure drops. Sizes: 1½- t 10-inch.



COPES Solenoid Valve has direct or tripper action. For pressure standards to 300-psi. Sizes: ¾- to 6-inch.

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POWER NEWS

BUSINESS ITEMS • APPOINTMENTS • FOREIGN FIELDS
WASHINGTON NOTES • NEW DEVELOPMENTS • CONVENTIONS

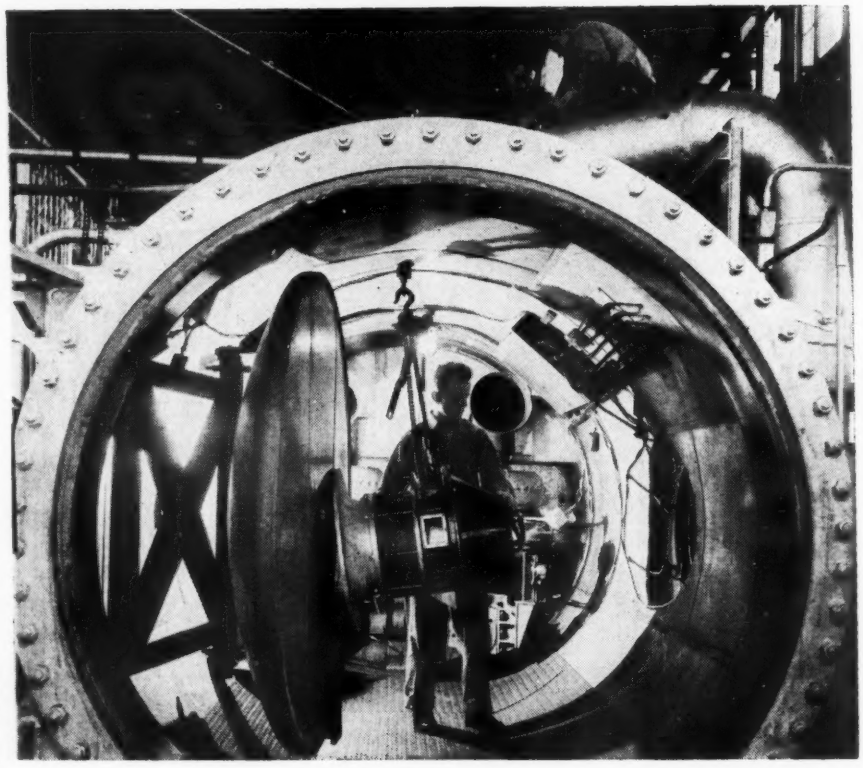
REA Organizes New Power Division

Rural Electrification Administration reshuffled its management and engineering units recently to set up a new power division. The new organization will take over all REA activities involving planning and operation of generating and transmission facilities.

Administrator Claude Wickard emphasizes that the reorganization move is pointed toward no increase in REA lending for construction of generating plants. On the other hand, it will allow swifter handling of applications for such loans, as well as for other power-supply matters involving REA borrowers.

Administrative organization of the power division also indicates new REA attention to power supply in general and generating systems in particular. Three sections are provided under the new unit: (1) Procurement section will deal with power sources, wholesale rates and contracts, and service to REA borrowers by wholesale energy suppliers. (2) Generation and transmission design and construction section will give technical assistance to borrowers in building their own generating and transmission facilities. (3) Generation and transmission management section

(*Continued on page* 154)



New Test Laboratory for Gas-Turbine Components

A $25,000,000 center at Lynn, Mass. for development, testing and production of aircraft gas turbines has been announced by General Electric Co. Since the war's end, nearly $11,000,000 has been spent for new facilities, including a test laboratory that consists of stands for full-power testing of compressor, combustion chamber, and turbine elements of actual engines, and model testing of single and multistage compressor elements. Scale-model turbine elements and individual combustion chambers of multichamber engines are tested in older, existing facilities

COMING EVENTS

Aug 2-6—Building & Maintenance Supplies Exposition, Grand Central Palace, New York, N. Y. Arthur Tarshis, president, 36 W 47th St, New York 19, N. Y.

Aug 23-26—National Assn of Power Engineers, annual meeting, St Paul Auditorium, St. Paul, Minn. A F Thompson, secretary, 176 W Adams St, Chicago 3, Ill.

Aug 24-27—American Institute of Electrical Engineers, Pacific general meeting, Davenport Hotel, Spokane, Wash. H H Henline, secretary, 33 W 39th St, New York 18, N. Y.

Sept 7-9—American Society of Mechanical Engineers, fall meeting, Reed College, Portland, Ore. Ernest Hartford, executive assistant secretary, 29 W 39th St, New York 18, N. Y.

Sept 14-17—New England Water Works Assn, exhibits and technical meetings, Hotel Pennsylvania, New York, N. Y. Arthur T Clark, secretary-manager, Water and Sewage Works Mfrs Assn, 170 Broadway, New York 7.

Oct 5-7—American Institute of Electrical Engineers, Middle Eastern district meeting, Hotel Statler, Washington D. C. H H Henline, secretary, 33 W 39th St, New York 18, N. Y.

Oct 11-13—National Lubricating Grease Institute, 16th annual convention, Edgewater Beach Hotel, Chicago, Ill. Carl E Bolte, executive secretary, 4638 Mill Creek Parkway, Kansas City 2, Mo.

Oct 18-22—American Institute of Electrical Engineers, Midwest general meeting, Hotel Schroeder, Milwaukee, Wis. H H Henline, secretary, 33 W 39th St, New York 18, N. Y.

Oct 18-22—National Safety Congress & Exposition, meetings in Stevens, Congress, Palmer House, Morrison and Sherman Hotels, Chicago, Ill. O E Burns, 20 N Wacker Dr, Chicago.

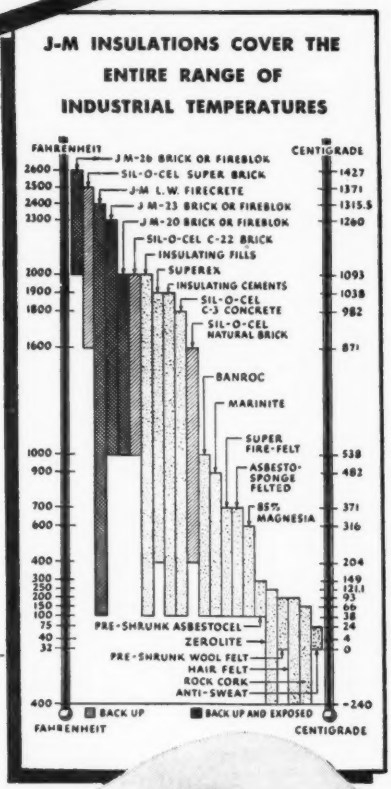
Facts about J-M Insulations
Subject: MATERIALS

The RIGHT Insulation helps industry offset higher fuel costs

TODAY'S higher fuel costs emphasize the importance of insulation more than ever before.

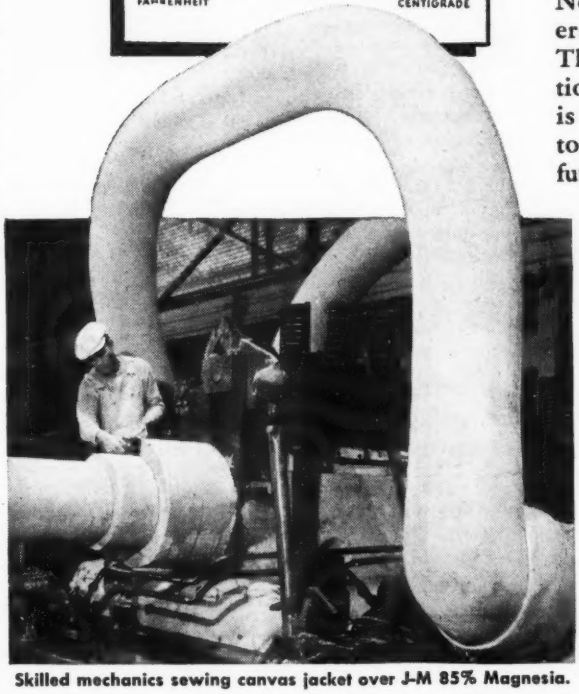
Average price at the mine for bituminous coal in 1931 was $1.54 per ton. In 1946, the most recent figure published, industry paid $3.44 per ton, and today the average price is estimated at more that $4.

Industry must choose the RIGHT Insulation to offset these higher costs. Any insulation will save *some* money. Only the *right* insulation, specifically engineered for a specific job, will save the most money for the longest period of time.



Special Insulating Problems solved with Special Materials

No single raw material will produce an insulation that operates efficiently under all industrial service conditions. That is why Johns-Manville manufactures many insulations from many selected raw materials. Johns-Manville is constantly developing and testing new insulations . . . to meet special industrial problems and to anticipate future needs of industry.



Skilled mechanics sewing canvas jacket over J-M 85% Magnesia.

J-M insulations, made from asbestos and other raw materials, span the entire range of temperatures from 400°F. below zero to 2600°F. above. On the job, they provide that right combination of physical and thermal properties so essential for proper application and maximum fuel savings.

Forming a link between you and Johns-Manville Insulation Research is a network of contracting firms specializing in the practical use of J-M Insulations. First, their insulation engineers choose the type and thickness of materials best suited to your needs. Next, skilled mechanics in their employ assure efficient, economical application.

For complete details and answers to your special insulation problems, write Johns-Manville, Box 290, N. Y. 16, N. Y.

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ENGINEER'S BOOKSHELF

REVIEWED IN THIS ISSUE

HEATING AND VENTILATING'S ENGINEERING DATABOOK

COMBUSTION ENGINEERING

PRINCIPLES OF JET PROPULSION AND GAS TURBINES

POWER SYSTEM STABILITY, VOL I

ENGINE ROOM Q AND A

CONSTRUCTION ESTIMATES AND COSTS

CORROSION HANDBOOK

BOILER FIREMAN'S HANDBOOK

RESULTS OF PUBLICLY-OWNED ELECTRIC SYSTEMS

CENTRIFUGAL AND AXIAL FLOW PUMPS

ELEMENTS OF NOMOGRAPHY

MANAGEMENT LEADERS' MANUAL

MANUAL OF ELECTRIC INSTRUMENTS

ELEMENTARY THERMODYNAMICS

SUPERCHARGING THE INTERNAL COMBUSTION ENGINE

ELECTRIC POWER AND A GOVERNMENT POLICY

SYNTHETIC PETROLEUM FROM THE SYNTHINE PROCESS

RADIANT HEATING

Heating, Ventilating

HEATING AND VENTILATING'S ENGINEERING DATABOOK. *By Clifford Strock.* 576 *pp*, 8½x11, *many graphs and charts, cloth.* $7. *The Industrial Press,* 148 *Lafayette St, New York* 18, *N. Y.*

Ten major sections cover the field. They include: heat and moisture in air, fuels and combustion, piping, air handling and ventilation, heating and heat transmission, cooling and air conditioning, motors and drives, contract law, mathematical data and drafting-room practice, terminology.

Emphasis on data needed in actual design rather than on explanatory text for design factors characterizes this book for practical men. Material should prove helpful to engineers, contractors, architects and students.

An added feature is the section on contract law. It discusses many legal phases involving heating, ventilating and air-conditioning jobs and installations.

Modern Steam Practices

COMBUSTION ENGINEERING. *Edited by Otto de Lorenzi, director of Education, Combustion Engineering Co, Inc. Over* 1000 *pp*, 6½x9½, *over* 400 *illust*, 80 *tables, cloth.* $7.50. *Combustion Engineering Co, Inc,* 200 *Madison Ave, New York* 16.

Over 30 members of Combustion Engineering Co contributed to this comprehensive reference and handbook. It deals with (1) methods (2) equipment for fuel-burning, steam generation and heat recovery.

Descriptions of all equipment by this manufacturer are highly practical and fully explanatory. Much of the early history of design and development for each major form of firing, steam generating or heat recovery unit is provided. Each chapter has down-to-earth, practical data such as recommended fuel-bed thicknesses, proper coal selection, suggested correct draft settings.

There are over 30 chapters ranging from origin and production of coal, fuels for steaming purposes through (1) separate treatments for major fuel-burning methods (2) ASME Boiler Construction Code (3) principal steam-generating designs (4) discussions of feedwater, purification and (5) selection, performance and testing. All this is backed up by an appendix that includes Mollier diagrams, steam tables, and typical coal analyses.

Jet Propulsion

PRINCIPLES OF JET PROPULSION AND GAS TURBINES (1948). *By M J Zucrow, professor of gas turbines and jet propulsion, Purdue University.* 563 *pp; 6x9; illust, tables, diagrams.* $6.50. *John Wiley & Sons, Inc,* 440 *Fourth Ave, New York* 16, *N. Y.*

A complete treatment of jet propulsion and gas turbines in aircraft applications, designed for graduate engineering students. Because the manuscript was prepared during the war no classified material is included, but basic treatment is complete despite this security limitation.

Chapter headings include: momentum and energy relationships of fluids, thermodynamics of gas flow, thermodynamic properties of air, airplane-performance calculations, airplane propeller, gas-turbine power plant, turbo-jet engine, air compressors, turbine characteristics, combustion chamber, rocket motor, high-temperature metallurgy.

Electric System Stability

POWER SYSTEM STABILITY—Vol 1 (1948). *By Edward W Kimbark, professor of electrical engineering, Northwestern University.* 355 *pp*, 6x9; *illust.* $6. *John Wiley & Sons, Inc,* 440 *Fourth Ave, New York* 16, *N. Y.*

This work on power-system stability is for power-system engineers as well as graduate students. It evolved from lectures by the author in a graduate evening course at Northwestern University.

The work is divided into three volumes. Volume 1 covers elements of the stability problem, the principal factors affecting stability, the ordinary simplified methods of making stability calculations, and illustrations of the application of these methods in studies on actual power-systems.

Not only is an understanding of power-system stability provided but also information on these topics: ac calculating boards, fault studies, circuit breakers, protective relaying, synchronous machine theory, and a step-by-step solution of nonlinear differential equations.

Engine-Room Practices

ENGINE ROOM QUESTIONS AND ANSWERS. *By Alex Higgins, consulting engineer,* 154 *pp*, 8½x11, *illust, cloth,* $4. *McGraw-Hill Book Co,* 330 *W* 42*nd St, New York* 18, *N. Y.*

Highly practical questions and answers on engine-room practices include design, construction and operation of (1) steam engines (2) turbines (3) engine-room accessories.

The book is prepared specifically to help students for operating licenses and certificates. Diagrams and sketches, selected with this end in mind, tie in closely with the text.

Over and beyond its highly practical turn, the book is an admirable reference handbook for engine equipment and operating procedure.

Construction Costs

CONSTRUCTION ESTIMATES AND COSTS (1947). *Second edition. By H E Pulver, professor of civil and structural engineering, University of Wisconsin.* 653 *pp; 6x9; illust, tables.* $6. *McGraw-Hill Book Co,* 330 *W* 42*nd St, New York* 18, *N. Y.*

Primarily for practical men who study methods of estimating construction costs, this second edition has brought up-to-date the industry costs as they existed in 1946. Many illustrative estimates enable clear understanding of the principles.

Chapter headings are: estimating in general, handling and transporting materials, excavation, piling and bracing, concrete, masonry, waterproofing, wood construction, structural steel, roofing and flashing, lathing and plastering, heating and air conditioning, plumbing, electrical work, painting, papering and glazing, heavy machinery, construction plant and equipment, overhead and profit.

Metal Corrosion

CORROSION HANDBOOK. *Edited by Herbert H Uhlig, associate professor of metallurgy. Mass. Institute of Technology.* 1221 *pp*, 5½x8, *cloth* $12. *John Wiley & Sons, Inc,* 440 *Fourth Ave, New York* 16, *N. Y.*

In 1942, The Electrochemical Society, aware of the tremendous national expense from corrosion of metals, created an organization within itself, known as the Corrosion Division. One of the division's first objectives was to sponsor a handbook to bring together for the first time the vast

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amount of vital information scattered throughout scientific and engineering literature. Dr Uhlig successfully correlated the combined efforts of 102 scientists and engineers, recognized as leaders in their field. Some material is entirely original.

In addition to being a condensed summary of corrosion information, the book includes a cross section of scientific data and industrial experience. Every aspect of corrosion is carefully considered in chapters covering the basic theory: corrosion behavior—aqueous and atmospheric—of metal and alloys, as well as behavior at high temperatures; protection against corrosion and corrosion testing.

A significant contribution is the glossary, standardizing definitions, and prepared by the Editorial Board and Subcommittee V of the American Coordination Committee on Corrosion. To avoid ambiguity, the sign of potential conforms with the convention adopted by The Electrochemical Society and National Bureau of Standards.

Combustion Problems

BOILER FIREMAN'S HANDBOOK. *By Joseph R Darnell, registered professional engineer.* 193 *pp*, 6x9, 139 *illust, cloth.* $3. *Technical Pub Co,* 53 *W Jackson Blvd, Chicago.*

This book helps firemen and power-plant engineers solve combustion problems. Chapter divisions are logical, beginning with fundamentals of combustion which discusses both terminology and theory. From here, the author takes up flue gas, heat transfer, sampling and testing, then goes back to fuels, firing methods, boiler-room auxiliaries.

Publicly Owned Systems

RESULTS OF PUBLICLY OWNED ELECTRIC SYSTEMS (1947-48, *9th edition*). 384 *pp*; 6x9; *illust, tables, paper.* $10. *Burns & McDonnell Engineering Co, PO Box* 7088, *Kansas City, Mo.*

A tabulation of 590 cities out of 3460 that have publicly owned central-station electric systems. Statistics are given on rates, earnings, expenses, investment, type of supply and other operating factors. Included are brief histories of several federally owned power systems.

Centrifugal Pumps

CENTRIFUGAL AND AXIAL FLOW PUMPS. *By A J Stepanoff, development engineer, Ingersoll-Rand Co.* (1948 *new*) 428 *pp*, 6x9 *in., well illustrated, cloth,* $7.50. *John Wiley & Sons,* 440—*4th Ave, New York.*

Centrifugal pumps meet practically all requirements of pressure, capacity, temperature, nature of liquid and operating speed. To make possible this development in pump design required extensive theoretical and experimental studies of cavitation, operation outside the normal head-capacity range, axial and radial thrust, effects of stuffing boxes on the critical speed of pumpshafts, control of head-capacity and brake-horsepower curves, pumping viscous liquids, etc, all of which are treated here.

Treatment combines theory and practical aspects. Theoretical treatment of the centrifugal pump deviates from that in existing books. Flow through the impeller is resolved into a meridional flow caused by the energy gradient drop and a circular motion, which may assume any one of many forms of vortex motion.

Many chapters, particularly those dealing with applications and operation of pumps, are practical. Therefore, even though the book was written primarily for pump designers, consulting engineers, and plant-designing engineers, the plant operator can use it to advantage.

Nomography

ELEMENTS OF NOMOGRAPHY (1947). *By Raymond D Douglass, professor of mathematics, and Douglas P Adams, assistant professor of graphics, both of Mass. Institute of Technology,* 209 *pp*; 6x9; 111 *illust.* $3.50. *McGraw-Hill Book Co,* 330 *W* 42*nd St, New York* 18, *N. Y.*

The book serves those who study by themselves and need a thoroughly practical presentation. Six types of alignment charts are treated rather than classifying the subject by equations. The value of orderly computations, careful scale designing and clear draftsmanship is stressed. Difficulties pertinent to scale work are thoroughly discussed, resulting in a more extensive treatment than in most books.

A large number of completed diagrams are included, many unreduced in scale so the reader may readily check measurements. Diagrams usually illustrate discussion points, but many are drawn for practical engineering use.

Managerial Problems

MANAGEMENT LEADERS MANUAL, *edited by James O Rice & M J Dooher, American Management Staff. Leatherette binding.* $3. *American Management Assn,* 330 *W* 42*nd St, New York* 18, *N. Y.*

Primarily for operating executives, supervisors and foremen, the book was compiled to promote wider understanding of managerial problems and techniques, particularly in human relations.

The seven sections deal with the management leader's human relations responsibilities, management leadership in a democracy, interviewing and counseling techniques, and means of diagnosing organization problems. Also included are tests to determine qualifications for management leadership.

Among the authors are Rexford Hersey, director, executive development and training, American Airlines, Inc; Leland P Bradford, director, adult education service, National Education Assn of U. S.; Ellis C Maxcy, personnel relations supervisor, Southern New England Telephone Co; Dr Ronald Lippett, Institute of Group Dynamics, Mass. Institute of Technology; John M Pfiffner, professor of public administration, University of Southern Calif.; E G Michaels, Vick Chemical Co.

The book is designed for individual reading to gain knowledge of the management tructure, for supervisory conference training through chapter-by-chapter discussion, as a desk manual for executives and supervisors, and for general reading as an introduction to practical, professional management.

Electric Instruments

MANUAL OF ELECTRIC INSTRUMENTS (1948) *Based upon teaching material in GE training courses,* 152 *pp,* 10¾x8¼; *illust.* $1. *General Electric Co, Schenectady* 5, *New York.*

This contribution to the more effective use of electrical instruments explains their operating principles as well as their application. All basic measuring instruments are treated, also many special instruments evolved from fundamental forms. For the most part, electronic instruments are omitted.

This is a manual for technical schools and colleges as well as for engineers who want to improve their knowledge of measuring tools in the electrical industry.

Thermodynamics

ELEMENTARY THERMODYNAMICS (1948, *revised*). *By Virgil M Faires, professor of mechanical engineering, Agricultural and Mechanical College of Texas.* 268 *pp,* 6x9½, 116 *illust.* $4.40. *The Macmillan Co,* 60 *Fifth Ave, New York, N. Y.*

This revision of a well-known book includes many small changes, among which are mention of the elementary gas-turbine cycle and probable layout of an atomic-energy plant. This edition, like the original, is designed for short college courses on thermodynamics. Brevity is achieved by reducing the number of subjects, rather than attempting to cover the full range of heat power.

Supercharging

SUPERCHARGING THE INTERNAL-COMBUSTION ENGINE (1948). *By E T Vincent, professor of mechanical engineering, University of Michigan.* 315 *pp,* 6x9, *illust, cloth,* $5. *McGraw-Hill Book Co,* 330 *W* 42*nd St, New York* 18, *N. Y.*

This book presents for the first time the essential fundamental theory of the various forms of superchargers and turbochargers in use today and their effects on engine cycle, power outputs and thermal efficiencies. While emphasis is largely on otto-cycle engines, where supercharging has been most widely practiced, a concluding chapter deals with supercharging the diesel engine, including recent developments in charging at relatively high pressures.

Beginning with a presentation of the thermodynamic fundamentals, the text deals successively with compressor types, the impeller and diffuser, estimating operating conditions, surging in centrifugal superchargers, testing, turbosupercharging and the axial flow compressor.

Engineers in the internal-combustion-engine field will welcome this volume for its collection of basic information on a currently important subject.

(*Continued on page* 140)

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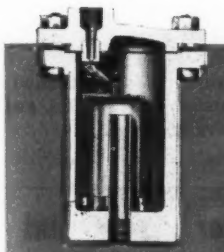

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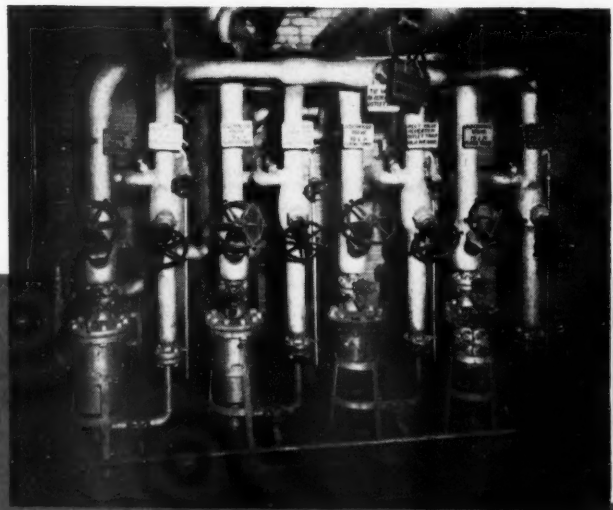

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Refrigeration Troubles

(*Continued from page* 106)

tion stop valve at compressor manifold. Start compressor. Slowly open suction stop valve. Open expansion valve when system begins to pump down.

B: Oil pump or lubricator pressure is too high. Compressor primes on oil. Stop unit long enough to permit oil to drain from cylinders. If oil-pump adjustment is correct, look for obstruction, such as a wick from a capillary lubricator, at the small oil-pressure regulating valve.

6. *Cylinders or cylinder heads or both get cold or remain cold when starting.*

A: Cylinder does not pump vapor because of sticking valves. Clean and repair compressor valves.

B: Liquid refrigerant expands back. Close expansion valve more.

C: Very cold jacket-cooling water with low compression ratio. Throttle water supply and raise head pressure (if necessary).

7. *Excessive warmth of compressor-enclosed crankcase.*

A: Oil filter or oil ducts, lines, etc are clogged with impurities. Clean oil system thoroughly.

B: Water or abrasive matter in lubricating oil. Remove oil, clean all internal parts with kerosene, carbon tetrachloride, or other oil solvent, and add suitable oil.

C: Bearings set up too tight. Adjust them properly.

D: Oil is unsuitable for required duty. Remove and recharge crankcase with oil of suitable quality.

8. *Compressor cylinder walls become excessively warm.*

A: Oil filter or lines to cylinders are stopped up. Clean compressor and oil system thoroughly.

B: Abrasive substances score cylinder walls. Clean compressor and oil system thoroughly.

C: Oil lacks proper lubricating qualities. Replace with oil of suitable quality.

D: Not enough jacket cooling water. Increase water supply.

E: Scale or sediment in water jacket. Clean jackets thoroughly, either manually or chemically.

F: Compression ratio is high. Reduce it by lowering condensing pressure.

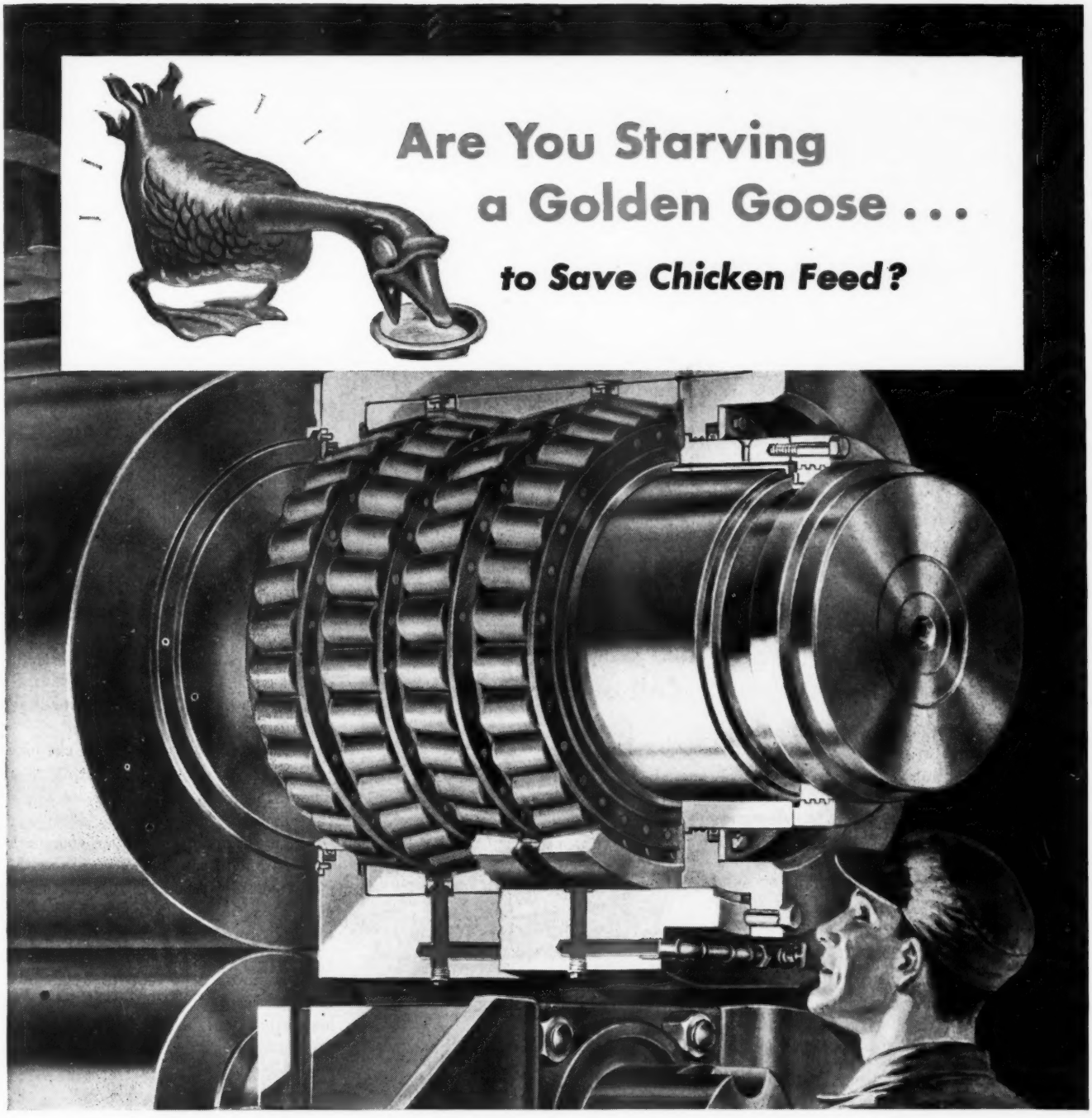
G: Recompression. Reduce tension of discharge- and suction-valve springs, and if possible increase valve openings.

Feedwater Treatment

(*Continued from page* 93)

promotes floc formation. Filters are gravity type with Wheeler bottoms, and the filter rate is slightly less than 2½ gpm per sq ft.

Caustic is fed into the filter effluent to raise the pH. Water then enters the



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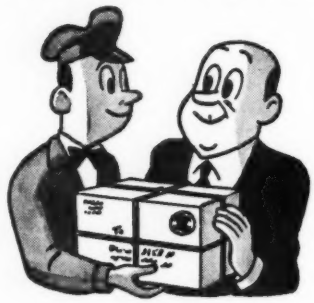

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40,000-gal clear well. Two vertical deep-well pumps deliver water from clear well to softeners.

All chemical feeders are wet type with electromagnetic proportioning mechanisms operated from a meter in the raw-water inlet.

Water Softeners. Softeners are carbonaceous-zeolite type. Two units are now installed, each 7 ft, 6 in. dia, with space for a third unit when plant capacity increases. Each unit has a peak capacity, at 8 gpm per sq ft, sufficient to handle total water requirements when other unit is out for regeneration.

Spray-type deaerator is designed for 200,000 lb per hr. Space for a second unit is provided when required.

Internal Treatment. Phosphate for internal treatment is mixed in an open tank and pumped directly to boiler drums. A 2-cylinder pump is used, one cylinder pumping to each boiler, with a single-cylinder pump as a spare. A timer that operates a 3-way valve in the pump suction-line controls chemical feed. During a part of the timer's 30-min cycle, the valve supplies phosphate solution to the pumps; during remainder of cycle, flushing water is pumped. Pumps also have adjustable strokes for controlling feed to each boiler.

Chemical Feed Tanks. All chemical feed tanks are on the operating floor. They are designed for 24-hr storage so that charging the tanks is done once each day. A chemical storage room near the equipment can store several months' supply of phosphate, caustic and ferric sulphate. Salt is purchased in carload lots and stored in an underground brine tank. Sulphuric acid, purchased in tank cars, is stored in an outside steel tank, from which it flows by gravity to the measuring tank in the building.

This system, in operation over a year, is satisfactory in every way.

The Bookshelf

(*Continued from page* 136)

SYNTHETIC PETROLEUM FROM THE SYNTHINE PROCESS (1948) *By B H Weil, State engrg experiment station, Georgia School of Technology, and J C Lane, chemistry division, Gulf Research and Development Co.* 303 *pp*, 5x8, *illust, tables, cloth*, $6.75. *Chemical Publishing Co, Inc, Brooklyn, N. Y.*

With future domestic-oil supplies questioned in many quarters, synthetic petroleum commands attention by both producers and users of petroleum products. Among the processes receiving current consideration, the synthine (or modified

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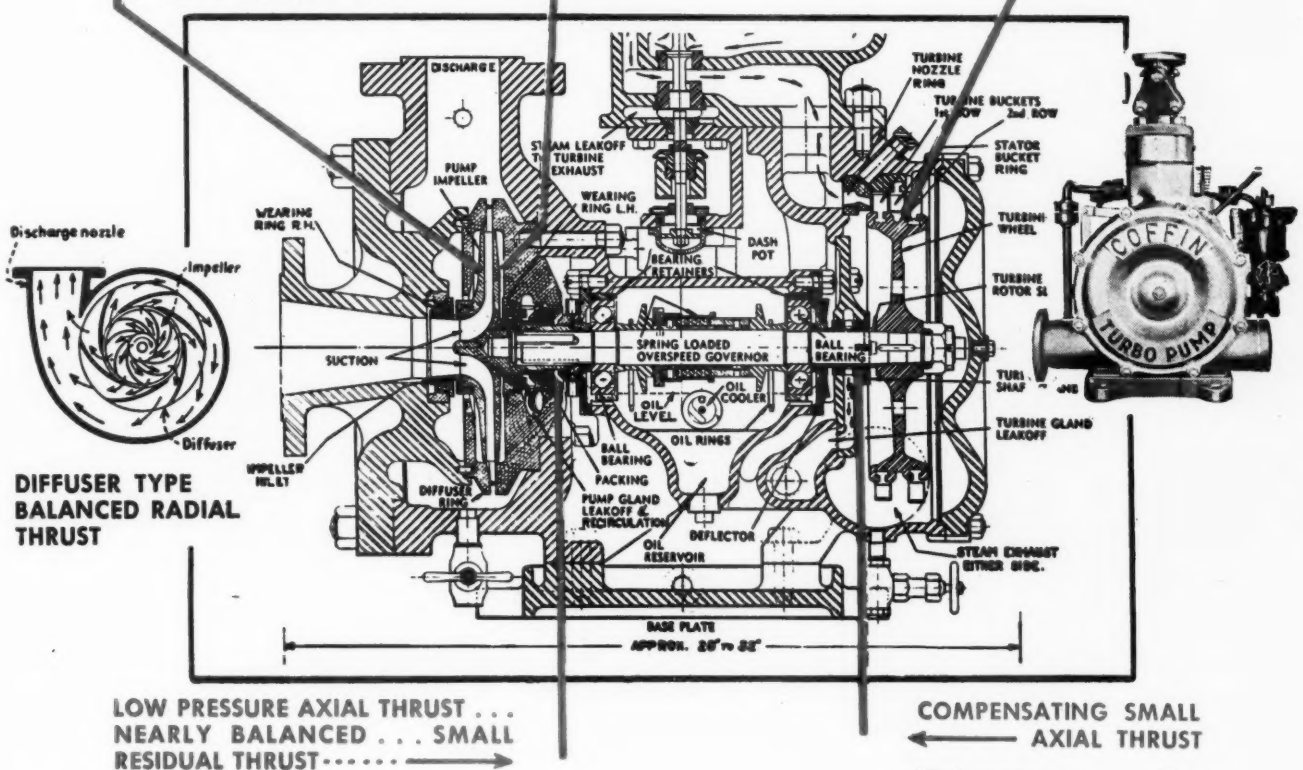

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Standardized Boiler Feed Units for:

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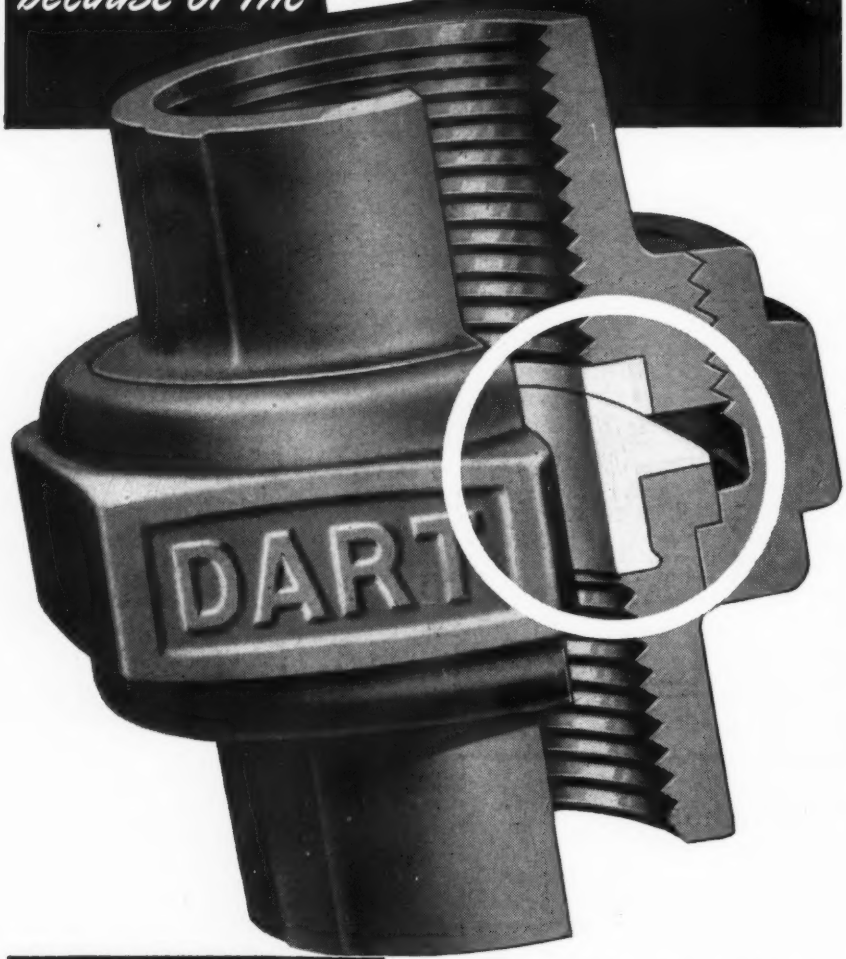

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Fischer-Tropsch) is generally regarded as the most immediately promising. This timely book reviews the present status of the synthine process, dealing with the production of synthesis gas from natural gas and coal, both on the surface and underground; the catalysts used; characteristics of the products and byproducts of the process, and the basic economics. Appendixes list patents, government reports and recent periodical references to the synthine process.

While the book contains matter that is the concern of chemical engineers and petroleum technologists, the text is handled so the nonspecialist follows it with little trouble. For this reason, power engineers will find it an up-to-date and comprehensive survey of developments in this part of the synthetic fuels field.

ELECTRIC POWER AND GOVERNMENT POLICY (1948) *By the Research Staff and the Power Committee, The Twentieth Century Fund.* 860 *pp,* 6x9, *illust, tables, cloth,* $5. *The Twentieth Century Fund,* 330 *W* 42*nd St, New York* 18, *N. Y.*

Based on a comprehensive survey of the relations between government and the electric power industry, this report gives the public an unbiased picture of how these relations have worked out—rate regulations, control of security issues and direct government ownership and operation—and some constructive thoughts on national power policy in the public interest.

Such topics are covered as regulation of price and service, financial organization of private systems, market areas and size of private systems; public-rural, federal and state systems; and the electric power resources of the nation. Operations of many large electric systems, both publicly and privately owned, are studied in detail, and analyses of TVA and other federal projects are included.

In addition to the book's factual findings, the final chapter includes recommendations of a representative Power Committee consisting of leaders with background in both privately and publicly owned systems as well as men experienced in government regulation and law making.

The engineer interested in the broad part played by power in our national economy will find this study a mine of factual information and the policy recommendations a stimulus to thought.

RADIANT HEATING. *By Richard Woolsey Shoemaker, consulting engineer.* 306 *pp,* 6x9, *many illust, cloth.* $4. *McGraw-Hill Book Co,* 330 *W* 42*nd St, New York* 18.

Practical applications of radiant heating to all types of buildings in various climatic conditions. Data and methods for designing one- and 2-story residential and commercial installations are detailed.

Specific locations of panels in residences and commercial buildings make up separate chapters. Heart of the system, the heating plant, forms a chapter that is one of the best reviews on present-day residential and commercial furnaces fitted for this service.

Other chapters discuss control, design and installation of radiant-heating systems. Radiant cooling constitutes still another chapter.

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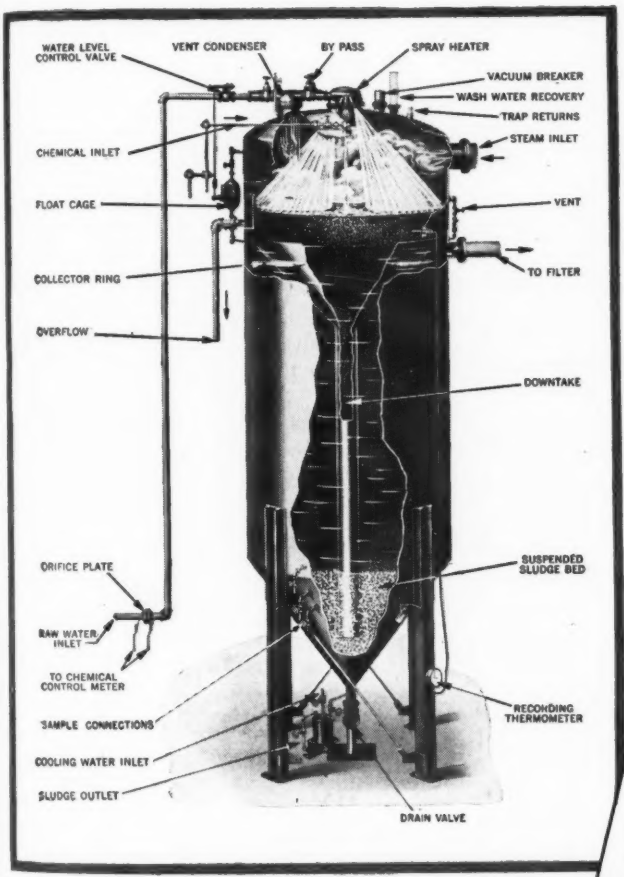

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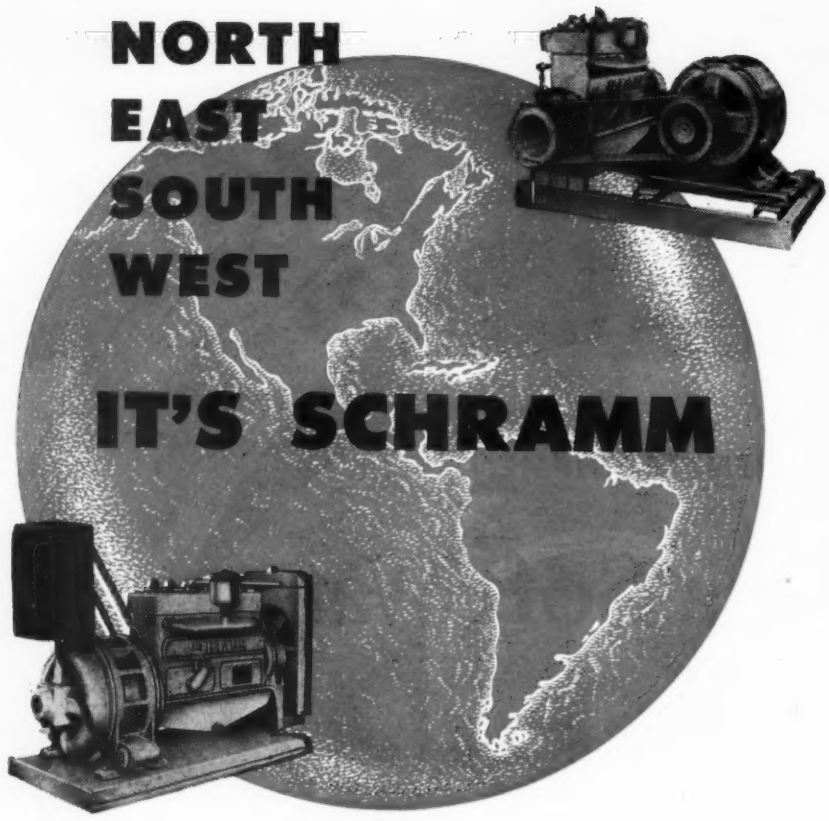

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Plant Problems

(*Continued from page* 114)

at sea level is 10.67 lb (both are absolute) only 1.34 lb are left for inlet- and suction-pipe losses. This is not enough and will certainly result in vapor binding of the pump. If he decides on an underground tank he must install the pump in a pit with the tank. **—J C Porter, Rock Hill, S. Car.**

Place Pump Below Tank

AW WILL COURT plenty of trouble if he locates pump above ground and attempts to lift hot water from a tank below ground. Pump will have to create a vacuum of about 8.82 in. to lift water, which will lower its boiling point and make it flash into steam causing pump to become vaporbound.

From our experience concrete tanks for hot water crack and allow seepage. If *AW* must locate his tank below ground, I suggest he build a concrete box in the ground, using a 1-2-4 mix with 5% lime. It should be well vibrated in the form, properly reinforced and large enough to hold a steel cylindrical tank of the required capacity, which can be insulated with conventional covering.

We strongly recommend installing the pump in the pit and, if possible, about two feet below the bottom of the steel tank. Use a single-stage centrifugal pump designed to work against a head of about 130 ft.—**C Demere, Memphis, Tenn.**

Use Insulated Steel Tank

I RECOMMEND *AW's* storage tank be installed above ground. Such tanks are often located on the plant roof, and hence must be insulated and waterproofed.

In one plant such a tank had on the inside a ¾-in. lining consisting of a cement wash first, then a plaster, which hardened to a marblelike finish. Outside of tank was cleaned to the bare metal and painted aluminum. After covering with asbestos blocks, asbestos roll paper was applied, followed by tar or roofing paper. Roofing compound was used as a finish.—**T F Cunningham, Philadelphia, Pa.**

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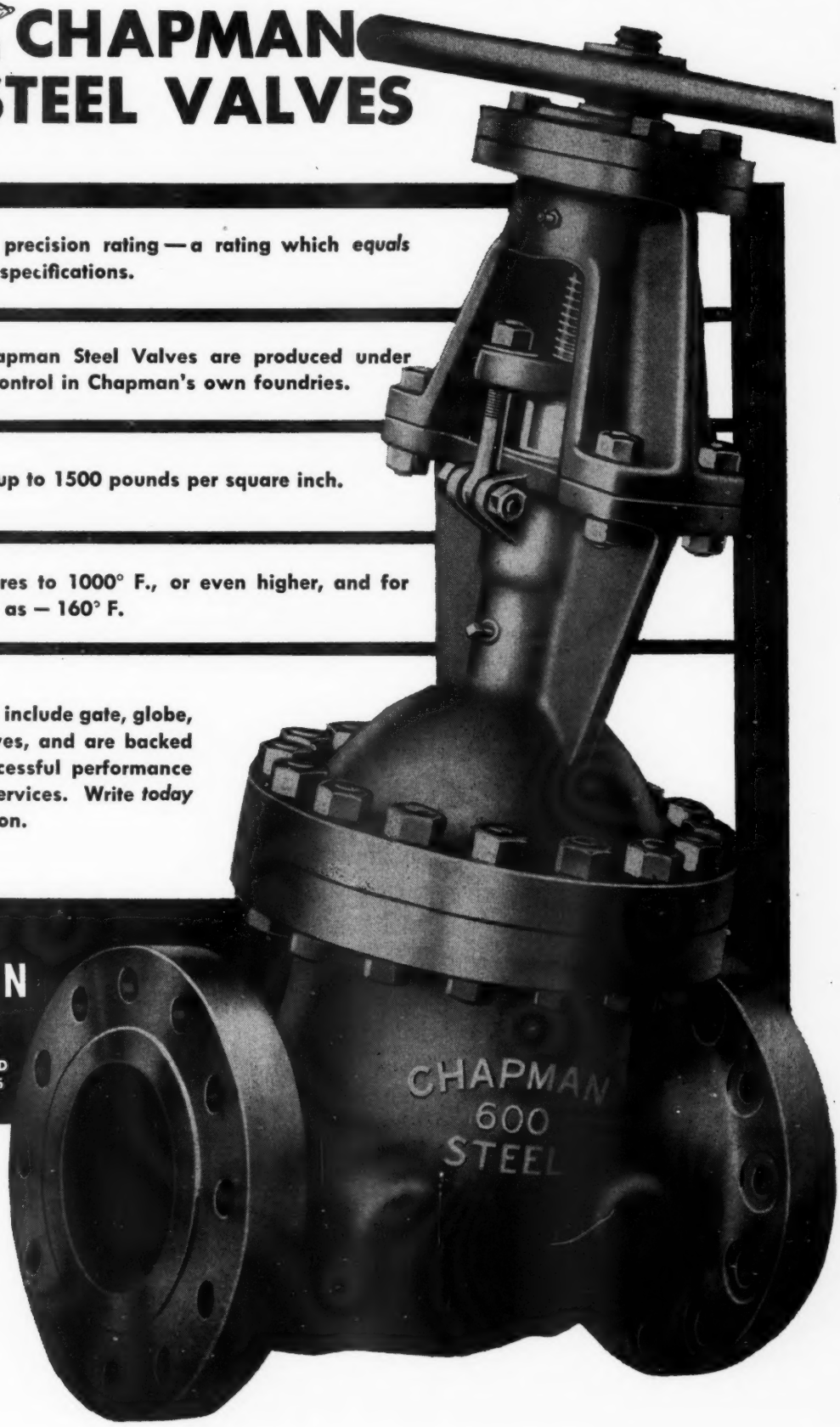

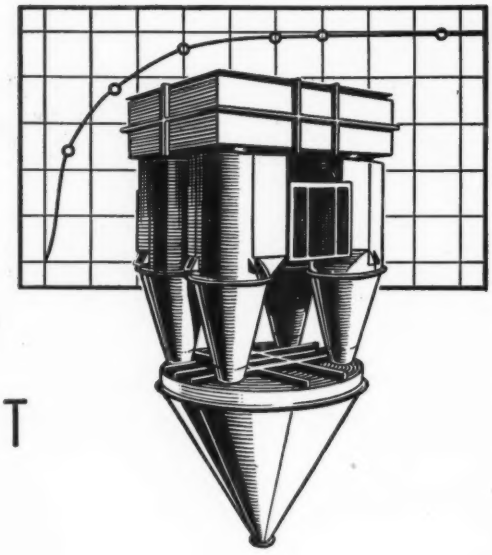

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buell

Engineered Efficiency in DUST COLLECTION

Rotary or Steam Jet?

(*Continued from page* 85)

the condenser controls the vacuum.

To the left of the curve intersections, the air pump is in control. With the assumed leakage rate and given air-pump capacity the air pump cannot meet the vacuum the condenser could otherwise produce. Inspection of the air-pump curves show the larger the pump or the greater the number of pumps operated, the more closely approached is the potential vacuum of the condenser. While lower circulating-water temperatures produce better vacuums, the capability of the air pump decreases at high vacuums, so at 65 F the air pump controls the situation over a greater load range. Nearly 0.1 in. Hg better vacuum may be obtained with the steam jet.

The condenser characteristics in Fig. 2 were derived by the usual calculation methods employing the data given on the figure and the Heat Exchange Institute heat-transfer rates for condensers (POWER, June 1945, pp 72-5). Air pump characteristics were calculated from equation (1).

Harry J Marks, New York representative of Erie City Iron Works, and a life member of National Association of Power Engineers No. 1, New York, also a life member of American Society of Mechanical Engineers, was recently presented with the Robert Grimshaw Medal (NAPE) at a meeting of No. 1. The citation mentioned Mr. Mark's 57 years' connection with the Association, the high quality of his work, and his leadership in his field of specialized engineering.

Watson-Stillman Co's President Edwin A Stillman announces that an increase, and not, as frequently predicted, a leveling off or decline in volume of capital goods sales, may reasonably be expected by heavy-equipment manufacturers in the next few years.

Addressing a management-group of the Roselle, N. J. organization on its 100th anniversary, Stillman gave reasons for predicting a growing demand for production machinery, particularly in plastics, press metal-working and railroad building industries, for which his company supplies hydraulic equipment. He said that sale of forged-steel pipe fittings is proceeding at such a rate as to tax production facilities of Watson-Stillman's distributor products div. Forged stainless steel and alloy fittings, he added, are on the increase throughout industry for corrosive, high-temperature and high-pressure applications; welded fittings continue to discover new preferences over the screwed type, although the latter still constitute the bulk of W-S shipments.

FREE AIR... *but it cost him his business!*

Air compressors seldom fail...but they *can* and *do* fail under certain conditions. *Oil*, for example, vaporized and mixed with air, can form an explosive charge... and be touched off by a fleck of hot carbon. A clogged intake filter may over-heat ... and there's TROUBLE. Remember ... unrelieved pressure builds up FAST!

Black, Sivalls & Bryson SAFETY HEADS offer complete protection from explosion due to over-pressure wherever you have a liquid or gas under pressure. *In the 100,000 plants where SAFETY HEADS are used, no pressure vessel equipped with a SAFETY HEAD has ever exploded.*

If your plant is not provided with the positive protection afforded by SAFETY HEADS have your Safety Engineer write for full information today. Address your letter to Industrial Power Department, Black, Sivalls & Bryson, Inc., 27th Floor, Power and Light Building, Kansas City, Missouri.

Ruptured SAFETY HEAD disc, showing full-throated pipe size relief opening.

*Illustration is an artist's conception of an actual filling station explosion which completely destroyed the building and contents. A Black, Sivalls & Bryson SAFETY HEAD costing only $5.00 would have relieved the overpressure which caused the explosion.

EFFICIENCY RELIABILITY

FOREIGN INQUIRIES INVITED Cable Address: BLACK, KANSAS CITY, U.S.A.

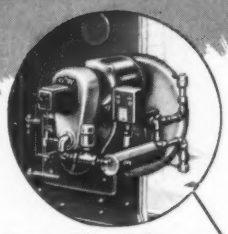
BLACK, SIVALLS & BRYSON, INC.

KANSAS CITY, MO. OKLAHOMA CITY, OKLA.

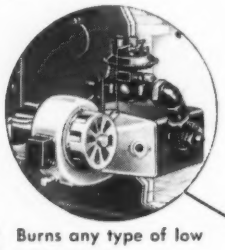
BEAT THE FUEL SHORTAGE!

GET REAL FUEL ECONOMY FOR YEARS TO COME!

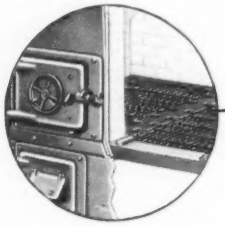
WITH DUTTON EconoMIST



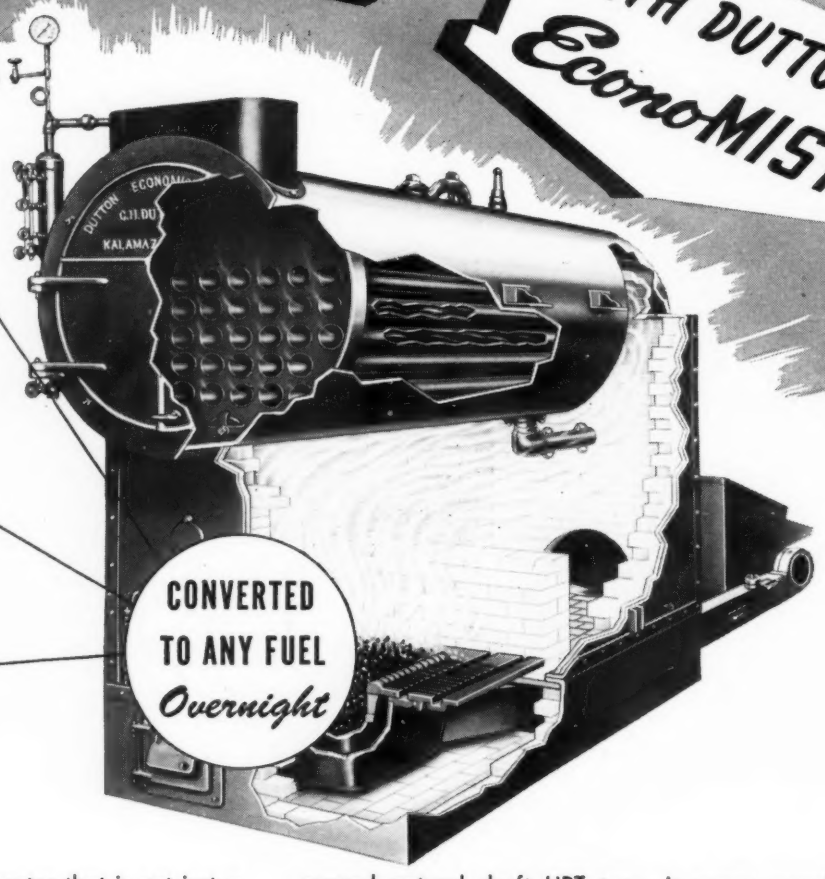
OIL Burns either light or heavy oil.



GAS Burns any type of low pressure gas.



COAL Either hand or stoker fired.

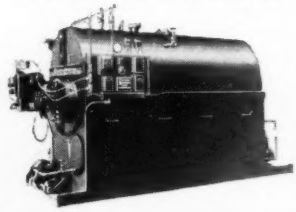


CONVERTED TO ANY FUEL *Overnight*

Here's a convertible steam generator that is not just a makeshift affair for use during the present fuel shortages. The Dutton Economist is engineered to give years of efficient service with any available fuel. The Economist is equipped with permanent grates for hand firing, with an oil or gas burner or with provision for stoker or burner installation in the field. The change from non-solid to solid fuel, or vice versa, can be made overnight. And no matter which fuel you use, you get the same high efficiency that Economist has always given its users. Thus you are not only protected against current fuel shortages but you can always select the fuel that gives you lowest steam cost.

The Dutton Economist is of the well-known, thoroughly-proved natural draft HRT type. It comes completely equipped with bricking, grating, insulation and all internal parts installed at the factory. The complete boiler is shipped on its own base and can be installed anywhere without special foundations. This is the boiler for those who are worrying about the fuel shortage now, and planning for the future. Write today for Bulletin EC-64.

DUTTON ECONOTHERM



A package-type steam generator for gas and oil firing only. Guaranteed 80% efficiency, the Econotherm has induced draft, rotary combustion, automatic operation and many more exclusive Dutton features. For information on the Econotherm, write for Bulletin EC-56.

THE C. H. Dutton COMPANY

622 GIBSON STREET • KALAMAZOO, MICHIGAN

PUTS THE PROFIT IN THIS EQUATION

The log mean terminal temperature difference goes down and stays that way when chlorination goes to work and stops slime formation on the water-side surfaces of your condensers and heat exchange equipment. This means lower fuel costs, less out-of-service time, the elimination of plug cleaning, more profit.

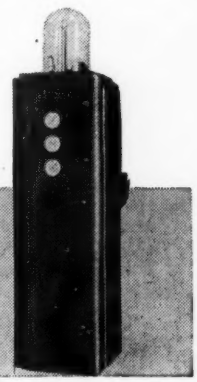
Since even the slightest slime film means a high LMTTD, it is important that the remedy get at the basic cause of the trouble—slime forming organisms. That's just what chlorination does and here are some typical examples of the profitable results:

A southern power station realized a net annual saving in steam costs alone of $16,000 from a W&T installation.

A refinery obtained enough savings through condenser de-sliming by chlorination to pay the cost of the installation in six months.

A midwestern power company obtained savings of $11,000 in one year through cooling water chlorination.

Call your nearest W&T Representative, backed by over thirty years' experience in water treatment, for a cooling water study of your plant—there's no obligation, of course, and you may find, as so many other plants have, that the LMTTD isn't as low as it could be with chlorination.



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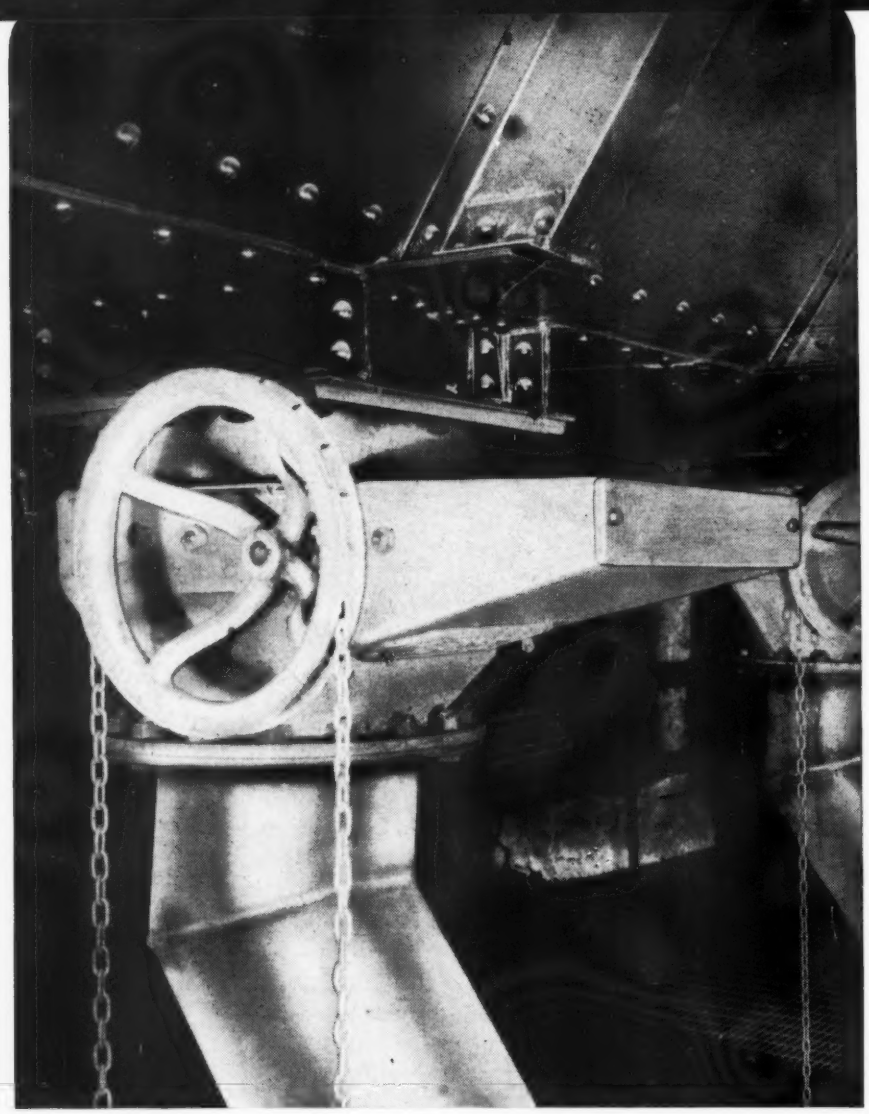
PRODUCTS, INC.
CHLORINE AND CHEMICAL CONTROL EQUIPMENT
Belleville 9, New Jersey • Represented in Principal Cities

CD-28



HERE'S WHAT YOU GET WHEN YOU SPECIFY

S - E - Co.

COAL VALVES

- U-SHAPED GATE—gives you easy operation.
- ROLLER BEARING, ROLLER MOUNTED GATE—also gives you easy operation.
- DUST TIGHT CONSTRUCTION—gives you a clean boiler plant.
- DOUBLE RACK AND PINIONS—gives you a square closing gate.
- GASKETED ACCESS OPENINGS—give you opportunity for quick internal inspection.
- MANY SIZES AND TYPES—gives you valves that fit your requirements.

For bulletin, address

STOCK ENGINEERING COMPANY

715 Hanna Bldg., Cleveland 15, Ohio

STOCK

CONICAL

Non-Segregating

Coal Distributors

S.E.CO.

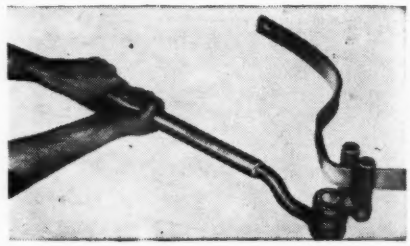
Coal Valves and Coal Scales

New Equipment

(*Continued from page* 126)

linkage, states the manufacturer.

Micropositioner serves well in positioning oil burner tips, injection nozzles, and governor gear on boiler feed pumps. **Hagan Corp, Hagan Bldg, Pittsburgh, Pa.**



Bending Bar E248

BENDING BAR NO. 2135 handles many jobs that would otherwise require a sledge hammer, pry bar, vise or press. The two adjustable arms can be placed close together or far apart, and they can be positioned on the hexagon post so the handle will project at desired angle. Ample leverage may be obtained with the 36-in. handle. It can be used to bend new work or straighten brackets, braces etc. **Plomb Tool Co, Los Angeles 54, Calif.**

Industrial Paint E249

DIRECTLY APPLIED, rust preventive paint requires no preparation of surface before application. *Rustrem*, a black paint, seals rusty surfaces and protects metal against exposure to moist or fume laden air. It serves as an ideal base for protective paint according to the claims of its manufacturer. **Speco, Inc, 3142 Superior Ave, Cleveland 14, Ohio.**

Deodorizing Cleaner E250

FREE-FLOWING, mildly alkaline cleaning powder soluble in hot or cold water processes has wetting, penetrating and detergent ability as well as a deodorizing action. *Di-Sanite* may be applied by sponging, wiping or mopping and is entirely free from abrasives and safe to use. **Oakite Products, Inc, 123B Thames St, New York 6, N. Y.**

Safety Goggle E251

LIGHT, SAFE, plastic goggle, about half the weight of a case-hardened glass lens, permits workers to wear them without discomfort. *Safe-T-Vis* lens, of allyl casting resin, come in four styles and a selection of sizes. **Univis Lens Co, Dayton 1, Ohio.**

Reflector Lamp and Plug E252

TWO NEW 75-watt, hermetically sealed, internal reflector lamps supplement the standard 150 and 300-watt R-40 bulb re-

THE ANTIMONIAL ADMIRALTY THAT'S TESTED BY TIME IS PATENTED BY CHASE

SINCE 1935 the resistance of Chase Antimonial Admiralty Condenser Tubes to dezincification has been remarkable. Why? Because Chase-patented admiralty has always contained more than the minimum amount of antimony to give protection against the escape of zinc.

Experience has shown that once the antimonial content goes below .007% (the minimum set forth in Chase Patent No. 2,061,921) there is relatively little protection. Chase's admiralty contains a nominal amount of 0.035% antimony to allow for commercial variation sometimes encountered. This assures you of an antimonial content of about .015% —the minimum necessary for reasonably complete protection. *That's why it pays to insist on Chase Antimonial Admiralty. Write today.*

Special stocks of ANTIMONIAL ADMIRALTY Condenser Tubes in Chase Warehouses at BALTIMORE, NEW ORLEANS LOS ANGELES, SAN FRANCISCO also carried by— Vinson Supply Co., TULSA Standard Brass & Mfg. Co. HOUSTON

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the Nation's Headquarters for BRASS & COPPER

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THIS IS THE CHASE NETWORK . . . *handiest way to buy brass*

ALBANY† ATLANTA BALTIMORE BOSTON CHICAGO CINCINNATI CLEVELAND DETROIT HOUSTON† INDIANAPOLIS KANSAS CITY, MO. LOS ANGELES MILWAUKEE MINNEAPOLIS NEWARK NEW ORLEANS NEW YORK PHILADELPHIA PITTSBURGH PROVIDENCE ROCHESTER† SAN FRANCISCO SEATTLE ST. LOUIS WATERBURY (†Indicates Sales Office Only)

Control Boiler Feed Water by

ionXchange

● **Here's why industrial plants, more and more, are changing to ILLCO-WAY ionXchange treated water for boiler make-up:**

1. **To prevent deposits on evaporative surfaces.**
2. **To control alkalinity.**
3. **To reduce the possibility of carry-over.**
4. **To reduce boiler blowdown.**
5. **To keep shutdowns for turbining and cleaning at a minimum.**
6. **To secure reduced-solids water at a cost comparable to softening.**

ILLCO-WAY DE-ALKALIZING EQUIPMENT assures accurate control of boiler feed waters. It removes all excessive bicarbonates and converts the remaining sulphate and chloride solids to non-scale forming salts.

On the very common high bicarbonate water, ILLCO-WAY De-Alkalizing equipment produces a feed water low in dissolved solids and free of all scale-forming properties. Controls are provided to maintain desired alkalinity.

For further information on the application of ILLCO-WAY synthetic resin technology and design developments on boiler feed water treatment, write for latest literature today.

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ILLINOIS WATER TREATMENT COMPANY

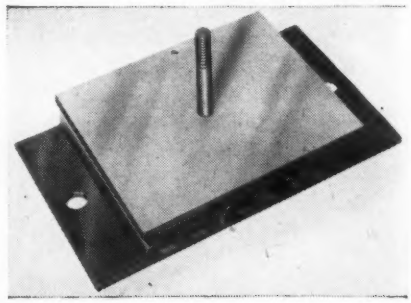
853-B Cedar Street, Rockford, Illinois • 7310-NN8 Empire State Bldg., New York City

ILLCO-WAY

DE-IONIZING
DE-ALKALIZING
SOFTENING

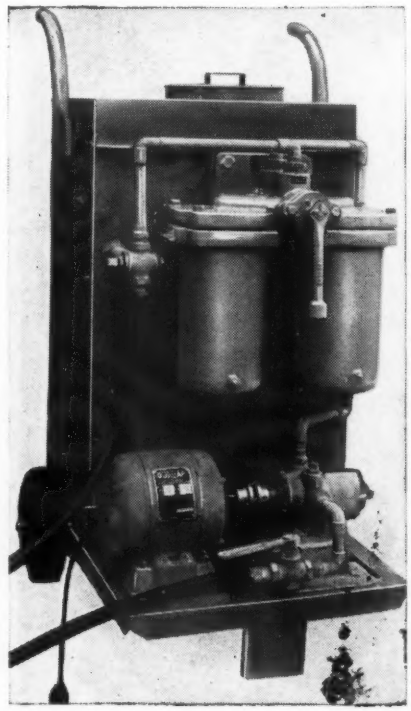
ENGINEERING AND EQUIPMENT DE-IONIZERS for process water treatment and treatment of liquids and solutions other than water; waste treatment; reclamation of specific constituents. DE-ALKALIZERS: Boiler feed (external); bottling water. SOFTENERS: Industrial, domestic. FILTERS, etc.

flector plug and spot lamps. The mushroom shaped R-30 bulb lamp is the smallest floodlight and spotlight lamp with built-in reflector available in standard voltage ratings of 115, 120 and 125 v. **Westinghouse Electric Corp, Pittsburgh 30, Pa.**



Vibration Dampener E253

STURDY, DURABLE, MACHINE MOUNTS involve no rubber to metal bonds that may break or separate in use. Steel retaining brackets hold synthetic rubber inserts in place. *Finnflex CM-H* mounts are built for horizontal and rotary vibration such as occurs with generators, compressors, pumps. *CM-V* mounts are designed for vertical vibration. **Finn & Co, 2850 Eighth Ave, New York 30, N. Y.**



Oil Flusher E254

BY A HIGH-PRESSURE nozzle jet, organic solvents, kerosene or lubricating oil is shot through the inspection or clean-out opening of housings around bearings, gears or cranks. The oil flusher makes it possible to loosen dirt, sludge or wear particles and force out water. Through a safety control device, flow of portable oil flusher may be reduced to a gentle flushing stream if desired.

The unit consists of a tank for holding

"DUAL BANK" IN TYPES FOR EVERY REQUIREMENT

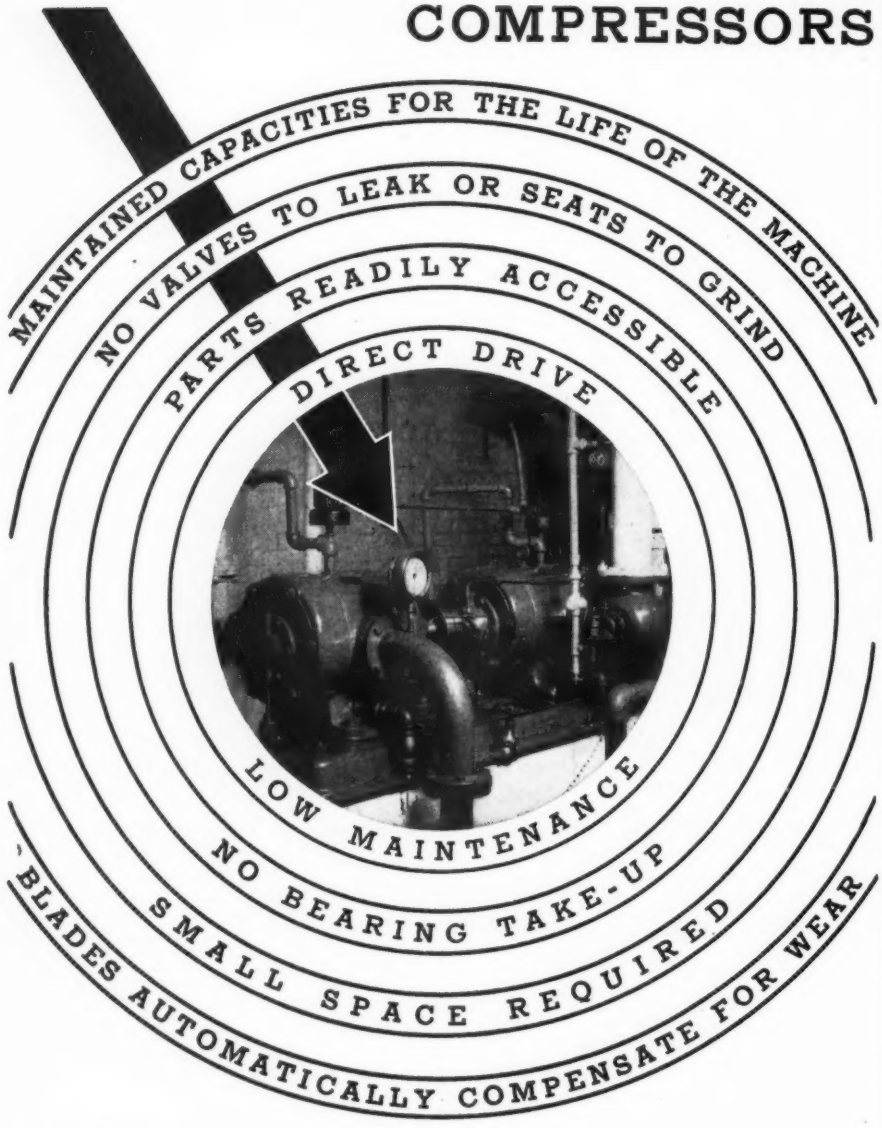
Dual Bank Efficiency, which closely approaches the "theoretical ideal" in surface condensers, can be obtained in any size and in types for every installation and operating requirement. In addition to the Standard and Low Headroom Types, are the Patented Reverse Flow Type, which automatically cleans its tubes and tube sheets periodically without a drop in operating efficiency, and the Divided Water Box Type, in which half of the condenser can be shut down for maintenance while the other half operates at reduced efficiency. . . . The advantages of "dual bank" tube arrangement, with the wide central steam lane and deep penetration feeder lanes, are fully described in our 44-page Catalog No. 1461. Write for it today.

C. H. WHEELER MFG. CO.
1800 SEDGLEY AVENUE, PHILA. 32, PA.
REPRESENTATIVES IN MOST PRINCIPAL CITIES

C.H. Wheeler OF PHILADELPHIA

STEAM CONDENSERS · AIR EJECTORS
COOLING TOWERS · HEAT EXCHANGERS

Hitting the Mark...
FULLER ROTARY COMPRESSORS


MAINTAINED CAPACITIES FOR THE LIFE OF THE MACHINE
NO VALVES TO LEAK OR SEATS TO GRIND
PARTS READILY ACCESSIBLE
DIRECT DRIVE
LOW MAINTENANCE
NO BEARING TAKE-UP
SMALL SPACE REQUIRED
BLADES AUTOMATICALLY COMPENSATE FOR WEAR

Fuller Rotary Compressors differ as radically from the conventional type of compressor as a centrifugal pump differs from the old-line piston pump. They have, in a relatively short period, earned a justifiable reputation as a dependable source of air power, with minimum attention and maintenance, together with sustained efficiencies.

They're built for long, continuous service . . . few moving parts: rotor—bearings—blades. Single and two-stage, for capacities to 3300 c.f.m., actual free-air delivery, pressures to 125-lb.

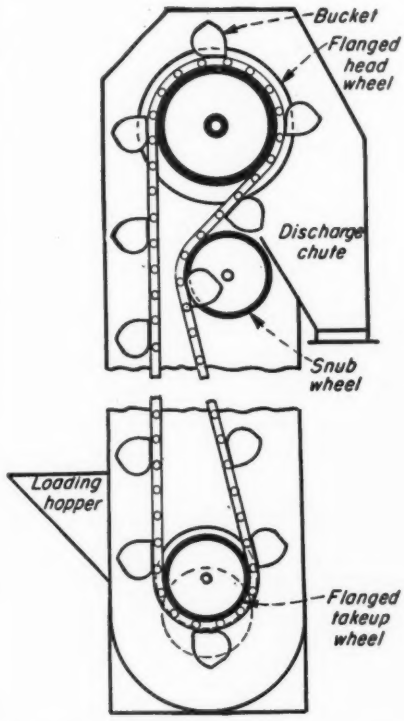
Write for Bulletin C-5, illustrating and describing these machines.

FULLER COMPANY, CATASAUQUA, PA.
Chicago 3 · 120 So. LaSalle St.
San Francisco 4 · 420 Chancery Bldg.

C-168

FULLER
A LIFETIME OF NEW MACHINE EFFICIENCY

and carrying flushing fluid to and from the machine to be cleaned, a pump and driver for actuating the flow, a filter for collecting the refuse cleaned out. Hoses, piping, valves and pressure safety controls are included. It is possible to use the unit as a simple lubricating oil circulating system. **Fox River Tool Co, Menasha, Wis.**



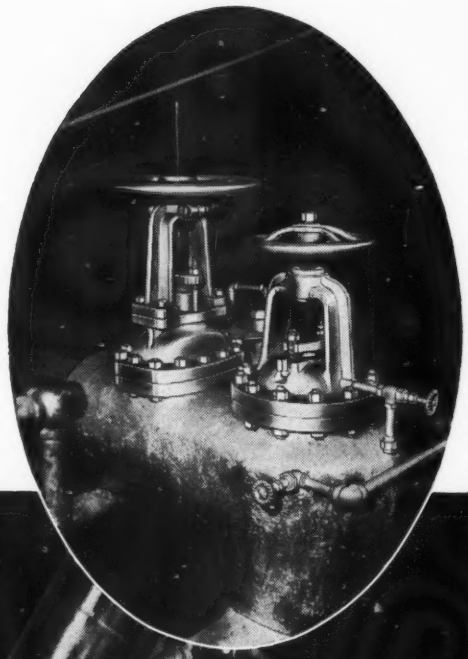
Bucket Elevator E255

FOR HANDLING CHEMICALS and bulk material, bucket elevator eliminates difficulties usually associated with handling of the materials. The use of a single strand chain and a double row of buckets permits high capacities when operating at either slow or high speeds. Even at slow speeds, flanged head wheel and discharge arrangement prevent spillage from the buckets when going over head-wheel. All material loaded into the buckets is discharged into chute at head of elevator. The perfect discharge and flanged head wheel permit handling of hot, light, fluffy, fine, coarse, abrasive, fragile or sticky materials without maintaining any particular ratio between bucket speed, head wheel diameter, bucket size and bucket spacing. **Beaumont Birch Co, Schaff Bldg, Race St, Philadelphia, Pa.**

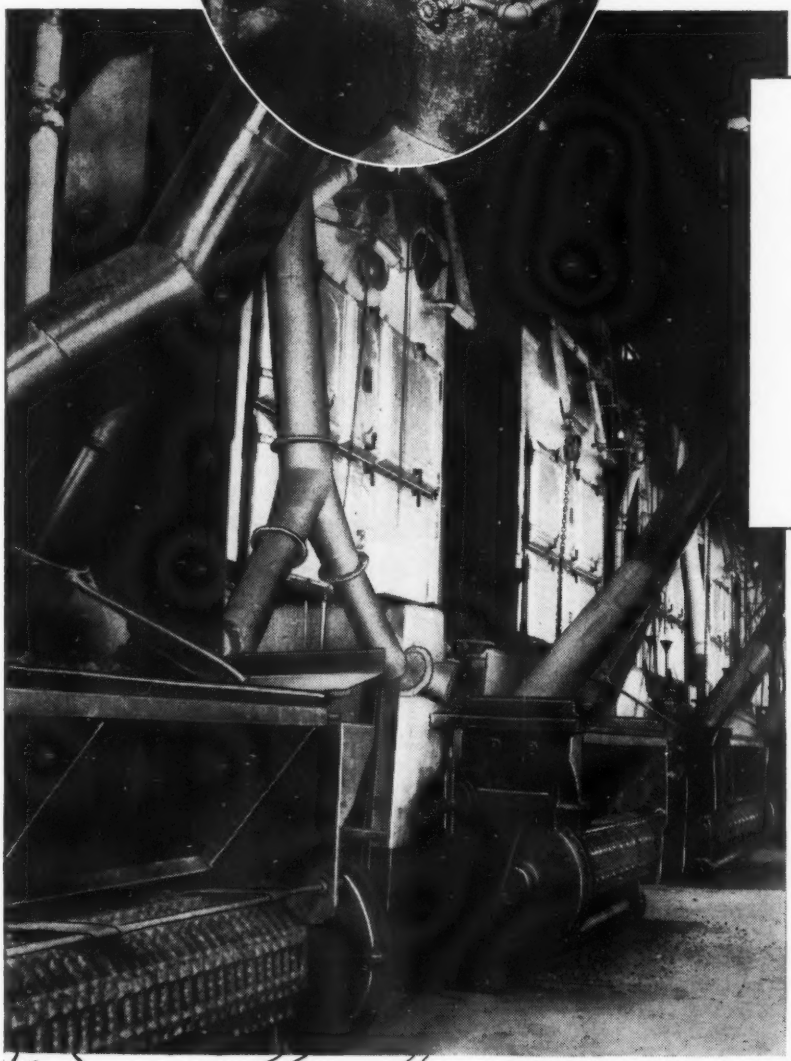
Solderless Connector E256

AVAILABLE IN 25 SIZES, and accommodating over 400 wire combinations ranging from No. 8 to 1,000,000 cir mil, the *XTP* connector will handle practically all tap jobs. Wide range of this connector reduces number of types users need carry in stock.

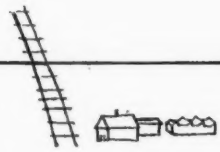
This new connector has one-piece, hinged construction, resulting in speed and simplicity of installation. It may be permanently attached to the main cable and left for the tap to be attached later. One end of connector is simply snapped over the main and tightened. **O Z Electrical Mfg Co, 262 Bond St, Brooklyn, N. Y.**



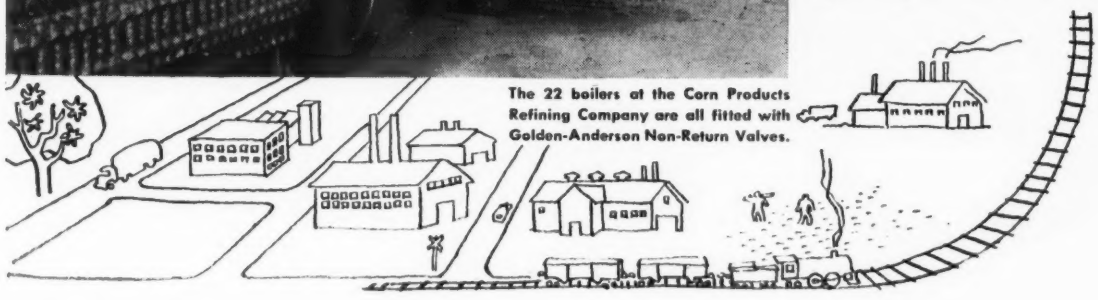
Satisfactory service for over 35 years on a *Tough assignment, too!*



GOLDEN-ANDERSON non-return Valves

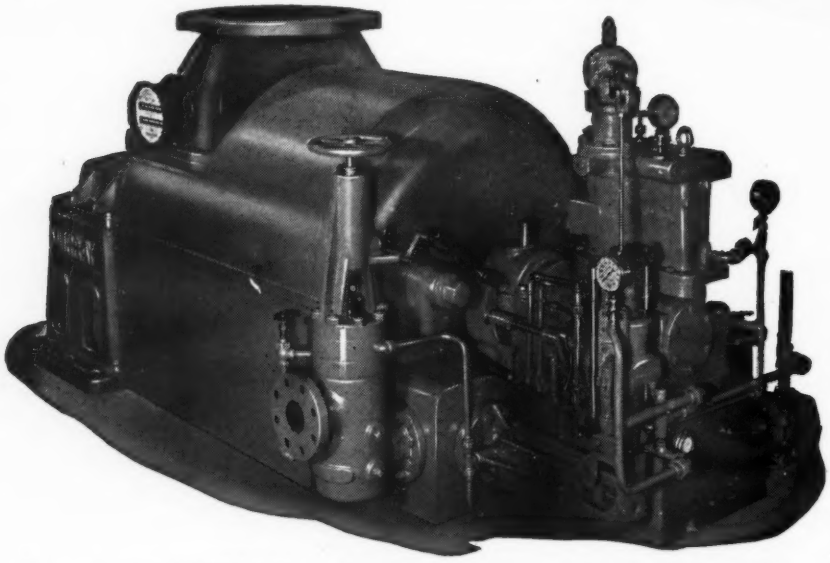


Golden-Anderson non-return valves will automatically cut in a boiler when its pressure equals line-header pressure, isolate a boiler automatically whenever its pressure is lower than line-header pressure, as well as prevent steam flow from boiler in event of sudden drop of line-header pressure below the boiler pressure. "Double Corliss" dashpot assembly cushions the valve and prevents banging, chatter or spinning under flow conditions.



The 22 boilers at the Corn Products Refining Company are all fitted with Golden-Anderson Non-Return Valves.

GOLDEN-ANDERSON *VALVE* SPECIALTY CO. · Keenan Bldg. · Pittsburgh 22, Pa.



One of two MURRAY multistage steam turbines, designed to deliver 685 horsepower on steam at 110 pounds and exhausting to 26½ inches Hg vacuum, furnished to drive high speed centrifugal compressors for refrigeration in one of the most prominent Southern Hotels. A third unit has recently been shipped. Equipment includes variable speed oil relay governor, trip and throttle valve, strainer surrounding the double seated balanced governor valve, and force feed lubrication.

MURRAY
MULTISTAGE STEAM TURBINES

★ ★ ★ ★

The complete MURRAY line of steam turbines includes all variations of mechanical drives, and turbine generator sets up to and including 3000 KW rating.

Sales Representatives for Murray products are located in all principal cities.

MURRAY IRON WORKS COMPANY

BURLINGTON, IOWA

Builders of Steam Power Equipment for Three Quarters of a Century

Power News

(*Continued from page* 132)

will advise on operation and maintenance of such facilities.

James B McCurley Jr, chief of REA's technical standards division, has been transferred to head up the new power unit. McCurley joined the REA staff in Oct 1946. John M Duncan is assistant chief of the power division. He has been with REA's engineering division since 1941. Milton Chase, who headed the planning group of the old generating and transmission section, acts as coordinator for the new division.

Another transfer from the old generating and transmission section brings Ivan A Bosman to the power division as head of the generation and transmission design and construction section. Bosman headed the internal-combustion unit of the g & t section. Franklin P Wood, chief of this section, becomes head of the generation and transmission management section. George A Ball, veteran rate engineer of the agency, heads the power procurement section.

Joseph E O'Brien succeeds McCurley as chief of technical standards division. He has been assistant chief since Dec 1946.

James A Powell, 59, of Stone & Webster, Dead

James A Powell, 59, chief mechanical engineer, Stone & Webster Engineering Corp, died suddenly at Boston on June 9. He was an outstanding designer of steam power plants in the U. S. and Philippines. A graduate of North Carolina State College in 1908, he earned his mechanical engineering degree there in 1913 and was awarded an honorary doctor of science in 1931.

In his early career he worked for the Westinghouse Machine Co, Pittsburgh, Elliott Co, and in 1930 became assistant chief engineer and vice-president of W S Barstow & Co. For five years he held such a post with E M Gilbert Engineering Corp, Reading, Pa., and in 1938 he was made vice-president of Utility Management Corp. In 1941 he joined Stone & Webster as mechanical engineer, becoming chief in 1945. Powell represented the U. S. at the last World Power Conference, held in Berlin, Germany. He held numerous patents on power-station equipment and was prominent in professional societies.

Walter Geist, president of Allis-Chalmers Mfg Co, Milwaukee, Wis, was awarded an honorary doctor of engineering degree June 7 by Michigan College of Mining and Technology at Houghton, Mich.

Limitorque Motorized Valve Controls

are operating day and night in these well-known

POWER PLANTS AND CENTRAL STATIONS

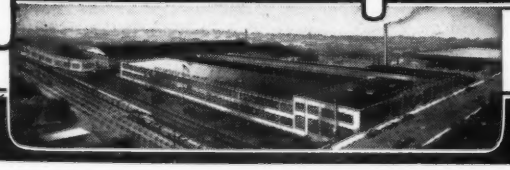
Hundreds upon hundreds of them operating by the mere "push of a button" (locally or remotely controlled)—opening and closing globe, gate, butterfly or plug valves; also, actuating damper controls, feeder dis-connect switches, doors, ventilators, etc.

Our new 96-page catalog is available upon written request on your Business Letterhead.

The word "Limitorque" has a definite meaning, because an exclusive Torque Switch actually limits the torque applied to the operating parts and thus prevents damage.

Ohio Power Company—Windsor
Atlantic City Electric Company
Deepwater Light & Power Co.
Arkansas Power & Light Co.
Cambridge Electric Light Co.
Carolina Power & Light Co.
Central Arizona Light & Power Co.
Central Illinois Electric & Gas Co.
Cincinnati Gas & Electric Co.
Cleveland Electric Illuminating Co.
Columbus & Southern Ohio Electric Co.
Commonwealth Edison Co.
Consumers Power Co.
Dayton Power & Light Co.
Duke Power Company
Eastern Shore Public Service of Md.
Florida Power & Light Company
Illinois Power Co.
Indianapolis Power & Light Co.
Louisiana Power & Light Co.
Luzerne County Gas & Electric Co.
Madison Gas & Electric Co.
Metropolitan Edison Company
Mississippi Power & Light Co.
Narragansett Electric Co.
New Bedford Gas & Edison Light Co.
New Haven Gas Light Company
New Orleans Public Services, Inc.
Ohio Edison Co.
Oklahoma Gas & Electric Co.
Potomac Electric Power Co.
San Antonio Public Service
Southern California Edison Co.
Southern Indiana Gas & Electric Co.
Tampa Electric Company
Union Electric Company of Illinois
Nebraska Power Co.
Connecticut Light & Power Co.
West Penn Power Co.
Riverville Power Co.
Niagara Hudson Power Co.
James H. Reed Station
Iowa Public Service Co.
Jersey Central Power & Light Co.
Public Service Co., Denver, Colo.
Public Service of New Jersey—Kearny, Burlington, West End and Essex Stations.
Brooklyn Edison Co.—Hudson Ave.
Hawaiian Electric Co.
Raritan River Plant, N. J.
United Electric Light & Power Co., N. J.
Virginia Public Service
Long Island Lighting Co.
United Illuminating Co. — English Station and Steel Point
Kansas City—Municipal Plant, Kansas
Borough of Vineland, N. J.
Houston Light & Power Co.
Phoenix Utility Co., Arizona
Phoenix Utility Co., Dallas, Texas
Electric Steam Station, Duluth, Minn.
Public Service, Michigan City, Ind.
American Gas & Electric Co., Deepwater, N. J.
City of Erie, Pa.
Derby Gas & Electric Co., Conn.
Consolidated Gas, Electric Light & Power Co., Baltimore, Md.
Pacific Gas & Electric Co.—Avon, Martinez, Oleum Stations, San Francisco, Calif.

Philadelphia Gear Works, INC.



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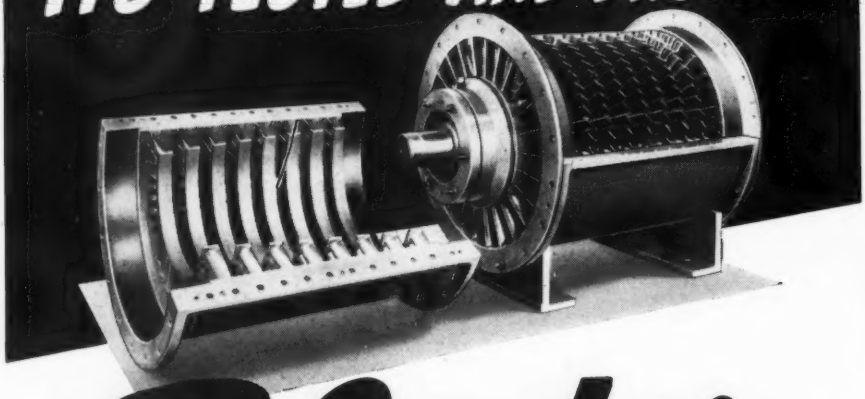
IN CANADA: WILLIAM AND J. G. GREEY LIMITED, TORONTO

Industrial Gears and Speed Reducers
LimiTorque Valve Controls

IT'S NEW! IT'S DIFFERENT!
IT'S TESTED AND PROVED!



Flader
Axial Flow Compressor

• Now—you can purchase an axial flow compressor which can deliver from 2000 to 300,000 cfm and pressures up to 100 psi may be obtained in a single unit. This Flader Compressor introduces an entirely new principle of industrial compressor design. It provides operating efficiency up to 88% and saves up to 20% power consumption in the larger sizes.

Floor area and general space requirements are less than 10% those needed for other type compressors and the weight is less than 10% of other type compressor weights. Drive may be either electrical, steam or gas turbine. Gas turbine drives are manufactured by us.

Write for Bulletin and further information.

This model only 22 inches long between flanges—only 17 inches case diameter yet delivers 18,000 cfm at 25 psig.

Fredric Flader, Inc.

NORTH TONAWANDA,
NEW YORK, U. S. A.

For Economical Production of Compressed Air in Large Volume

GE Produces Turbine-Generators at High Rate

Producing at an all-time record rate, the General Electric turbine plant at Schenectady turned out enough turbine-generators in first four months of this year to supply industrial and home power to a city of more than 2,500,000 population, reports J W Belanger, manager of GE turbine divisions. Twenty-three turbine-generators, with a combined capacity of more than 960,000 kw, were completed from Jan through April. Most of the units have been shipped and will be delivering power soon to many parts of the country. Adding production of smaller turbines at GE River Works, Lynn, Mass. and plant at Fitchburg, Mass., the total is more than 1,000,000 kw.

"The Schenectady turbine plant definitely set a record for production up through April, and other company plants are at near-record levels now," Mr Belanger comments. Looking ahead, he says the company is optimistic. "If production continues at the present rate, the Schenectady plant alone will produce more than 2,600,000 kw of turbine-generators before the year's end. Most of the steel needed for the sets scheduled for the remainder of this year has already been procured."

George C W Golem, of Atlantic Wire Co, Dead

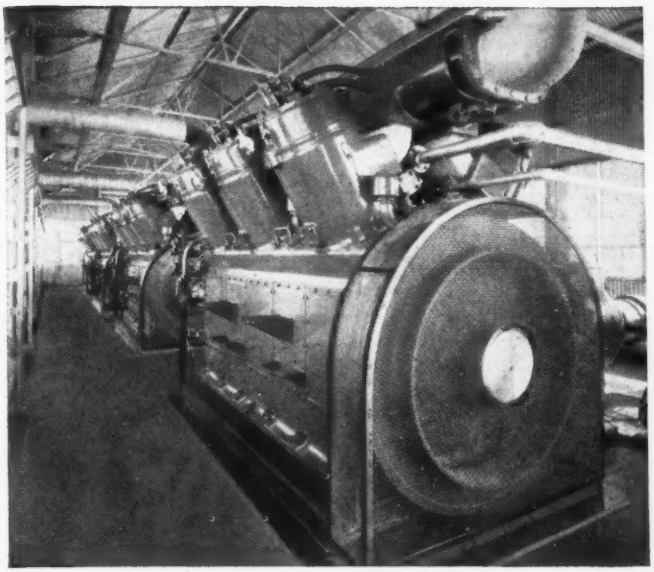
George C W Golem, chief power engineer of Atlantic Wire Co, Bradford, Conn, died suddenly June 12. For 21 years, power problems at this plant had been his responsibility.

He was a member of American Society of Mechanical Engineers and past president of local No. 10, New Haven, of National Association of Power Engineers. A registered professional engineer in State of Conn., he served on occasion as consultant. Readers of POWER will remember his contributions in the field of plant operation.

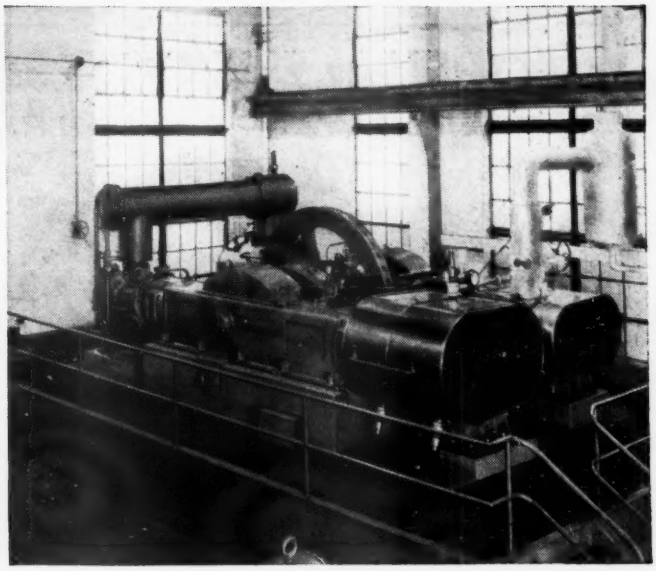
Ground has been broken for an addition to New York State Electric & Gas Corp's electric-generating station at Greenidge, N. Y., which will double capacity of the unit.

Expansion of Niagara Hudson Power Corp's steam-electric generating facilities in Oswego, N. Y., to a 4-unit station with a capacity of 360,000 kw, was announced by President Earle J Machold.

Interest in development of atomic energy has led the Commonwealth Edison group of companies to invest $100,000 in the University of Chicago's Institute for Nuclear Studies. Chancellor Robert M Hutchins announced that the Utilities Research Commission, representing the Edison group, has become a member of the Institute. The commission is the research agency for Commonwealth Edison Co, Public Service Co of Northern Illinois, Western United Gas & Electric Co and Illinois Northern Utilities Co.



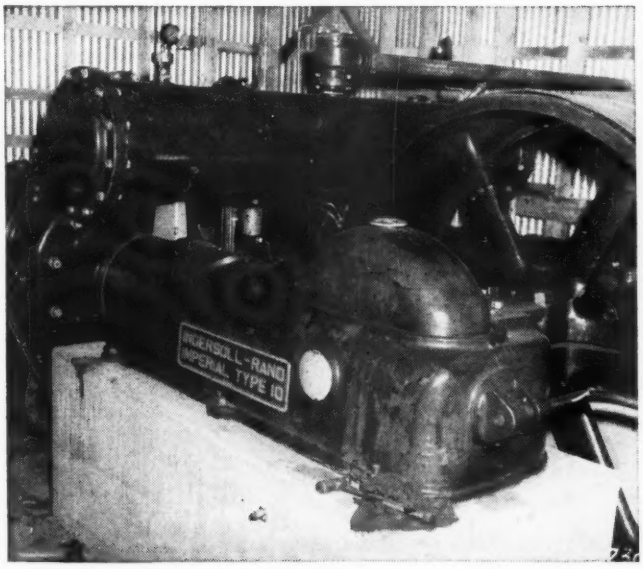
The wide use of compressed air in industry focuses sharp attention on the problems of efficiency and economy of operation. Both problems are frequently controlled by the proper grade and type of lubricant used.

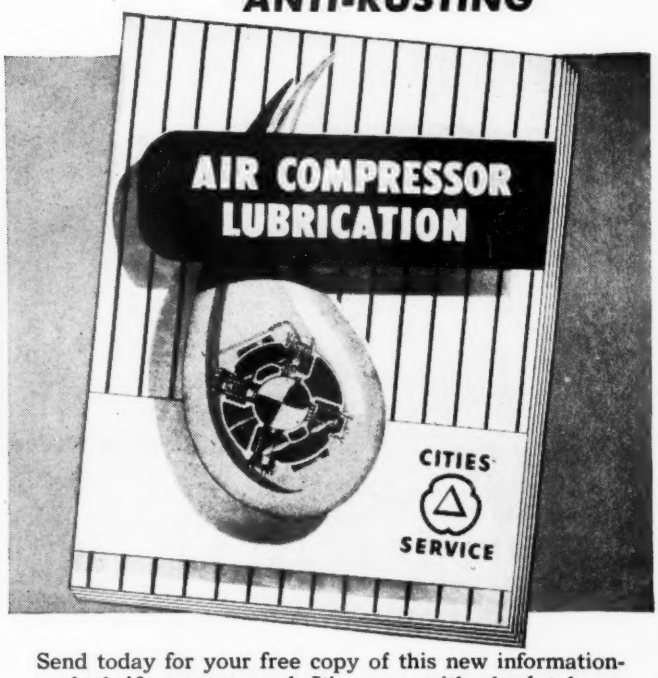


Regardless of the size or type of your compressor, the oils used must be carefully selected and skillfully applied. A Cities Service Lubrication Engineer will recommend up-to-date compressor lubrication methods.

Cities Service Air Compressor Lubricants are Three Ways Better!

ANTI-OXIDATION
ANTI-FOAMING
ANTI-RUSTING





Cities Service new Compressor Oils are chemically fortified to resist the formation of oxidation products, foaming and rust. They assure cleaner terminal equipment and normal action of piston rings and valves.

Send today for your free copy of this new information-packed 40 page manual. It's yours with absolutely no obligation. Write Cities Service Oil Co., 60 Wall Tower, Room 187, New York 5, N. Y.

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QUALITY PETROLEUM PRODUCTS

"TOPS" by EVERY TEST

Capacities to 150 G.P.M. — Heads to 600 Ft.

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- Simple — Wear-Free — Compact
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The ONLY MOVING PART IN The APCO

APCO is the highest development of the Turbine-Type Pump. No Metal-to-Metal contact. Handles NON-LUBRICATING liquids almost indefinitely without wear. Applicable for Water Supply, Boiler Feed, Condensation Return, Circulating, Transfer, Booster, Self Priming, Marine, Distillery, Dairy, Special Metal and "1001" Duties. Delivers with slight change in capacity against drastic head conditions.

AURORA CENTRIFUGAL PUMPS

A complete line, notable for streamline coordination between impellers and shells, including Horizontally Split Case, Single and Two Stage, Side Suction, Vertical, Non-Clog, Sump, Mixed Flow, Deep Well Turbines. Special Design, etc.

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AURORA Always PUMPS

AURORA PUMP COMPANY

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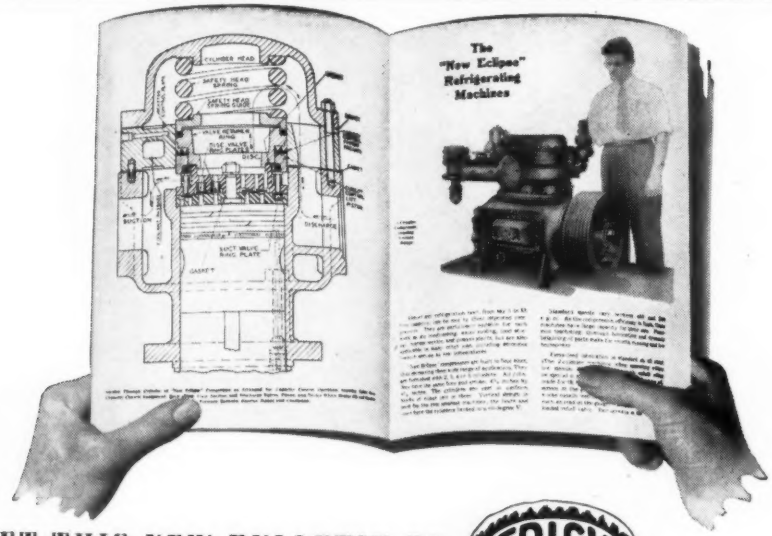
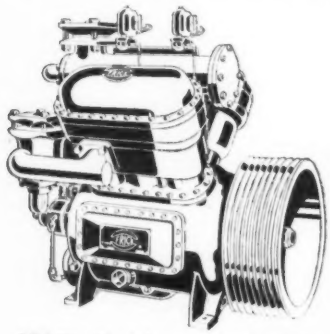


GET THIS NEW BULLETIN ON TRADE FRICK MARK **Refrigerating Machines**



6-Cyl. "New Eclipse" Compressor, One of Four Sizes

It tells all about the "New Eclipse" compressors . . . how they meet the needs of restaurants, theatres, stores, institutions, offices, factories, ships, and others . . . for dependable air conditioning, food storage, or special refrigeration work.

If you need commercial or industrial refrigerating machines handling Freon-12, ask for your copy of Frick Bulletin 100-D.

DEPENDABLE REFRIGERATION SINCE 1882

FRICK CO.

WAYNESBORO, PENNA. U.S.A.

Plant Expansion Plans

Salt River Valley Water Users' Assn has authorized expenditure of three-fourths of a million dollars for a new 7500-kw electric generator to combat a critical Arizona power shortage. The unit will be installed at the association's power plant north of Tempe. It will replace the U. S. Navy's mobile generating plant scheduled to be removed from the Tempe plant next Oct and will greatly augment the association's power-producing capacity (See POWER, June, pp 90-96).

A new 15,000-kw power-generating unit will be installed at Lincoln, according to Loup River Public Power District. Action is aimed at forestalling a possible power shortage in 1951. The plant will include a new building, boiler, turbine, watercooling tower and related equipment.

The third 30,000-kw unit recently ordered for the Bellevue plant, now under construction by Nebraska Public Power System, will not be completed until 1952. The new Lincoln unit will be in addition to the two 30,000-kw units now under construction at Bellevue plant and the additional unit that is on order.

Connecticut Light & Power Co is pushing steam-plant expansion at Devon. Installation has begun on a new 60,000-kw Westinghouse condensing turbine unit scheduled for service in 1950. This will be followed by a similar 60,000-kw unit to replace a 25,000-kw machine now in operation. Steam for the first named unit will be supplied by a 600,000-lb-per-hr Combustion Engineering boiler. Operation will be at 1250 psi and 950 F. The company recently completed installation of a 31,250-kw General Electric turbine-generator, replacing a 14,000-kw unit at Montville in 1918. Installation here of a second 31,250-kw machine is well under way. By 1951 the company expects to have increased its wartime generating capacity by about 200,000 kw. Important transmission-line construction is scheduled to enable eastern and central Connecticut to utilize this additional generating capacity.

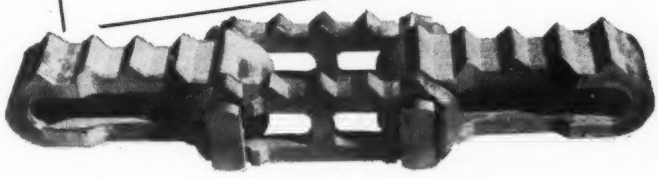
Additional steam-generating facilities have been ordered for Cambridge Electric Light Co and New Bedford Gas & Edison Light Co, subsidiaries of New England Gas & Electric Assn. A second Westinghouse turbine unit will be installed at Kendall Square station in Cambridge. Its rating will be 25,000 kw, 1250 psi, 900 F and 3600 rpm. First unit at this plant, now under construction, is to go into service in 1949. This is a Westinghouse extraction-type machine, about 20,000-kw rating, and the two units will be served by two 200,000-lb-per-hr Babcock & Wilcox boilers. Steam will be sold to industries and others in this part of the city.

A 25,000-kw turbine unit has lately gone into regular service at New Bedford station. A new machine, to be built by Westinghouse, and rated at about 35,000 kw, has been ordered. Combustion Engineering will provide a 300,000-lb-per-hr boiler. Studies are being made as to economical expansion of New Hampshire Gas & Electric Co's steam plant at Portsmouth.

A Corrosion-Resistant Metal that is strong at RED HEAT

Mold Flasks
1900°F

Conveyor Chains
1800°F



HASTELLOY alloy C—a corrosion-resistant alloy—is finding increased use where high operating temperatures are combined with corrosive conditions.

Take heat-treating furnace parts, for example. For this service, metals must be strong at temperatures of 1600 to 1900 deg. F., must withstand the thermal shock of repeated quenching to room temperature, and must resist the corrosive attack of furnace gases. Because HASTELLOY alloy meets these requirements so successfully, it is used for conveyor chains and links, rails, buckets and trays, and mold flasks.

All four grades of HASTELLOY alloy—A, B, C, and D—are available in a variety of forms to meet your corrosion and high-temperature problems. For more complete information, ask to have a representative call, or write for the booklet, "HASTELLOY High-Strength, Nickel-Base, Corrosion-Resistant Alloys."

Haynes Stellite Company

Unit of Union Carbide and Carbon Corporation

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HAYNES TRADE-MARK alloys

The registered trade-marks "Haynes" and "Hastelloy" distinguish products of Haynes Stellite Company.

RODA

High grade gas, by-product and steam coal from Wise County, Va., on the Interstate Railroad.

DENDRON

High grade gas, by-product, steam and domestic coal from Wise County, Va., on the Interstate Railroad.

STONEGA

High grade, high volatile steam and by-product coal from Wise County, Va., on the Interstate Railroad.

PREMIX STOKER

A laboratory controlled product blended to meet exacting stoker requirements. From Wise County, Va., on the Interstate Railroad.

GLENBROOK

The Premium Kentucky Splint unmatched for domestic use—now under development in Harlan County on the L. & N. Railroad.

COKE

Roda and Stonega from Wise County, Va.

CRITERION COAL

High grade gas, by-product, steam and domestic coal—Pittsburgh seam from Irwin Basin, Westmoreland County, Pennsylvania, on the Penna. Railroad.

CROZER

Genuine Pocahontas from McDowell County, W. Va., on the Norfolk & Western Railroad.

LYNCO

High fusion coking coal for by-product, industrial stoker and pulverizer use from Wyoming Co., W. Va., on the Vgn. Ry.

Old Kentucky

Hazard No. 4 and No. 7 steam and domestic coal from Wiscoal, Knott County, Kentucky, on the L. & N. Railroad.

ANTHRACITE

Hazle Brook and Raven Run Premium Coal.

Our personnel with the experience gained through long and varied marketing activity assures effective servicing of any fuel requirement.

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BRANCHES:

BLUEFIELD, W. VA. BOSTON BUFFALO CHARLOTTE, N. C.
CINCINNATI NEW YORK NORFOLK PITTSBURGH

APPOINTMENTS

General Electric Co has announced that Earl O Shreve, vice-president of GE on the president's staff and president of U. S. Chamber of Commerce, has retired from the company after 44 years of service. Lloyd R Stanley has been appointed assistant production manager of Lynn turbine manufacturing div. Edwin M Shultes III, of Albany, N. Y., has been named counsel for chemical dept. Shultes succeeds A Cohen, who will continue as patent counsel for chemical dept, with headquarters in Schenectady. Frank E Golliher has been made production supervisor of plastics div. Charles W Bentley is named assistant to manager of new Decatur, Ill., plastics molding plant. David B Folkerth becomes chemical dept district representative at Pittsburgh office. H Arthur Howe has been appointed manufacturing manager of compound div, Pittsfield, Mass.

Lawrence A Franks is named manager of Boston district office of **H K Porter Co** at 294 Washington St.

Elgin Softener Corp announces that William F Brandt has been made district engineer of Minneapolis territory, which includes Minn., N. D., S. D. and northwestern Wis. Brandt will be at 2552 Byrd Ave, Minneapolis, Minn.

Charles A Gleason, engineer in charge of technical condenser-tube service for **Scovill Mfg Co,** Waterbury, Conn., has retired. Maurice C Presley succeeds him.

Belco Industrial Equipment Div, Inc, Bogue Electric Mfg Co, has appointed Watermasters, Inc, of Houston, Texas, to represent them in the southwest.

Dale Torgeson has joined research dept of **Harbison-Walker Refractories Co,** Pittsburgh, Pa.

Square D Co appoints three new regional managers: (1) S T Walz, with headquarters at Atlanta, will manage Southeastern region, which includes Atlanta, Charlotte, Jacksonville and Birmingham district offices. K R Morris, with headquarters at Baltimore, will manage Eastern region, which includes Baltimore, Philadelphia, New York and Richmond district offices. (3) R W Thompson, with headquarters at St. Louis, will manage Midwestern region, which includes St. Louis, Kansas City, Moline and Omaha district offices.

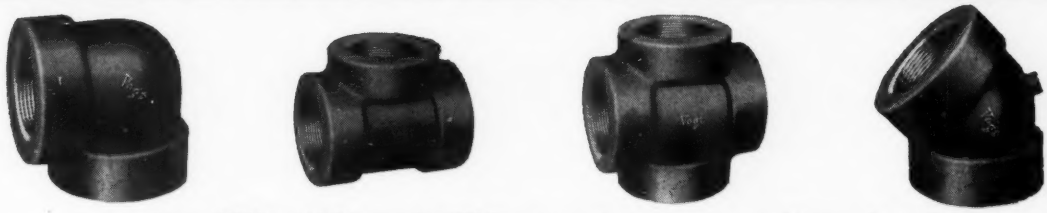
G B Wright has been made sales engineer of small engine dept, heavy machinery div, **Nordberg Mfg Co,** Milwaukee 7, Wis.

Bailey Meter Co has opened a branch office in Charlotte, N. C., with J R Powell as manager. He is assisted by R T Cathey. These engineers are available to advise and assist power and process engineers in N. and S. C. and eastern tip of Tenn. on proper application of measuring and controlling devices.

Robert L Moog has been named eastern div manager for **Geo D Roper Corp** pump div. Moog takes charge of New York office, 55 W 42nd St, where he supervises sales of Roper rotary pumps in N. Y. state, Conn.

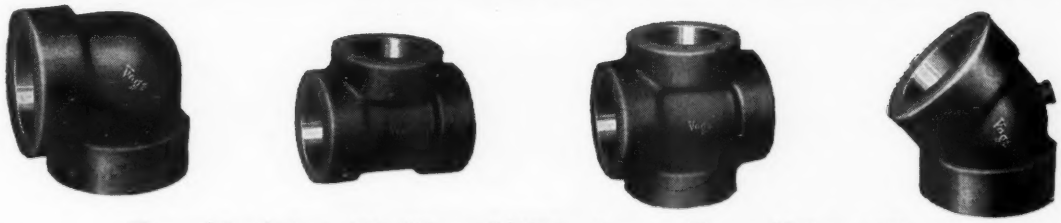
STRENGTH

for Safety and Long-Time Service



For 2000, 3000 and 6000 pounds service — Sizes 1/8" to 6"

SCREW END TYPE



For schedules 40, 80 and 160 pipe — Sizes 1/8" to 4"

SOCKET WELD TYPE

Vogt Ells, Tees, Crosses, etc., are forged from carbon steel or various alloys to meet specific operating conditions. Catalog F-8 will aid you in their selection and proper application.

Shocks and stresses imposed by high pressures and high temperatures are taken in their stride because Vogt fittings are uniform in structure, fine grained, and free from porosity . . . the superior product of laboratory controlled materials and giant forging hammers and upsetters. These properties also give higher resistance to erosive and corrosive conditions, thereby adding to service life expectancy in steam plants, petroleum refineries, chemical plants and related industries.

HENRY VOGT MACHINE CO., INC.
Louisville 10, Kentucky
BRANCH OFFICES: NEW YORK • PHILADELPHIA • CLEVELAND • CHICAGO • DALLAS

Vogt DROP FORGED STEEL FITTINGS

HI-LIFT

PEERLESS

REG. U. S. PAT. OFF.

FOR DOMESTIC

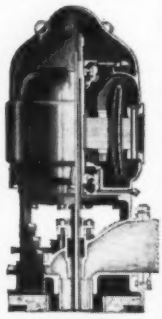
COMMERCIAL

INDUSTRIAL

MUNICIPAL

AGRICULTURAL SERVICE

The low cost pump for developing a maximum water supply from small diameter wells



FULLY PATENTED BY R. MOINEAU & PEERLESS PATS.

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CAPACITIES: *600 to 3300 Gallons per Hour from well depths to 600 feet.*

PEERLESS PUMPS

Here is one of the most simple and most positive of all deep well water pumping systems. In the Hi-Lift, Peerless utilizes an ingenious pumping element to literally squeeze water upward. Its pumping element consists simply of a hard chrome helically contoured rotor revolving in a similarly contoured rubber stator. That's all there is to this positive Peerless method of water lifting. It's the most forward step in pumping developed in the last 10 years.

Hi-Lift's pumping element is water lubricated, operates at half the usual pump speed; resists sand cutting abrasion and corrosion. When used with pressure tank, extremely high pressure may be developed without change or adjustment. These and many other Hi-Lift features are sure to make big savings in your water supply costs.

Peerless Bulletin B-142 fully describes and illustrates the many advantages of the Hi-Lift Pump. Write for copy today!

PEERLESS PUMP DIVISION

FOOD MACHINERY CORP.

LOS ANGELES 31, CALIF.; INDIANAPOLIS, IND.

District Offices: New York 5, 37 Wall Street; Chicago 40, 4554 No. Broadway; Atlanta Office: Rutland Bldg., Decatur, Ga.; Dallas 1 Texas; Fresno, Calif.; Los Angeles 31, Calif.

and northern N. J. Lester B Hyde, who had been div manager of this territory for the past 14 years, has retired from business.

J S Coffin Jr, Co announces appointment of following additional industrial agents: (1) John N Fehlinger Co, New York City, for metropolitan New York (2) Frank D Riggio Co, Rutherford, N. J., for northern N. J. (3) William F Lewis, Buffalo, N. Y., for western N. Y. and northwestern Pa.

Thomas G Gleason has been added to New York office staff of **Peabody Engrg Corp.**

John O Glenn is appointed manager of pump and compressor merchandising sales of **Worthington Pump and Machinery Corp,** Harrison, N. J.

Link-Belt Co has opened a district sales office in Albany, N. Y., with headquarters at 444 Broadway. J Charles Bullock has been made district sales manager at Albany. Schenectady office is now discontinued.

Henry A Samer has been named works manager of Norwood, Ohio, plant of **Trumbull Electric Mfg Co.**

Littleton C Barkley has been appointed general sales manager, asbestos and rubber products, west coast div, **Raybestos-Manhattan, Inc.** In his new capacity, Barkley supervises sales of Manhattan Rubber, Asbestos Textile and Packing and Equipment Sales Divisions of the corp.

Wendell G Fogg becomes executive engineer of **Air Reduction Sales Co.** In his new capacity Fogg will assist the director in planning, coordination and review of activities of research and engineering dept.

Dampney Co of America, Hyde Park, Boston 36, Mass., announces broadening of its industrial sales representation through addition of two new distributors. *Apexior* and *Thur-Ma-Lox* protective coatings are now available in Houston area through Curtiss Johnson Co, and in New Oreans through Woodward Wight & Co, Ltd.

Clyde H Irwin has been assigned as field engineer in charge of Pittsburgh office of **Infilco Inc.**

Monsanto Chemical Co, Springfield Mass., announces appointment of G Theodore Barks as general superintendent of new vinyl-chloride production unit. Salvadore P Lio has been transferred to the position of operating superintendent of new vinyl-chloride plant and Louis Schroeder has been made area supervisor.

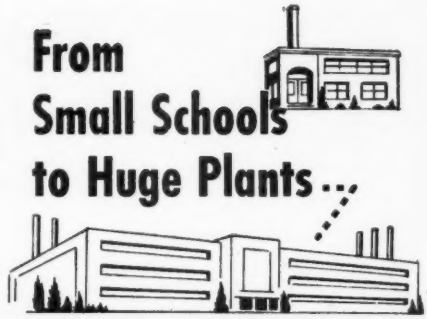
J F Mattern has resigned as vice-president, general manager and treasurer of **Vulcan Soot Blower Corp,** Dubois, Pa., and will resume management consulting service.

Swartwout Co has appointed George R Mellema Co as Minneapolis representative of ventilator div.

Hahn Equipment Corp announces that it recently merged with Pitz Foundry, Inc. The new corporate name is **Hahn-Pitz**

(*Continued on page* 174)

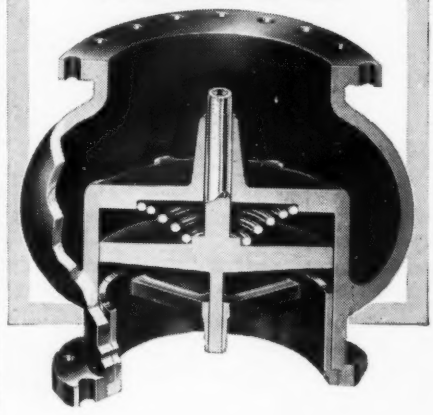
From Small Schools to Huge Plants...



WATER HAMMER is serious

but is so easily eliminated with

THE WILLIAMS-HAGER *flanged* SILENT CHECK **VALVE**



Write for complete information on The Williams-Hager Flanged Silent Check Valve—that has proven successful on the most difficult installations.

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Pump Valves . . . Water Gauges . . . Gauge Cocks . . . Steam Traps . . . Pump Governors . . . Feed Water Regulators . . . Water Columns

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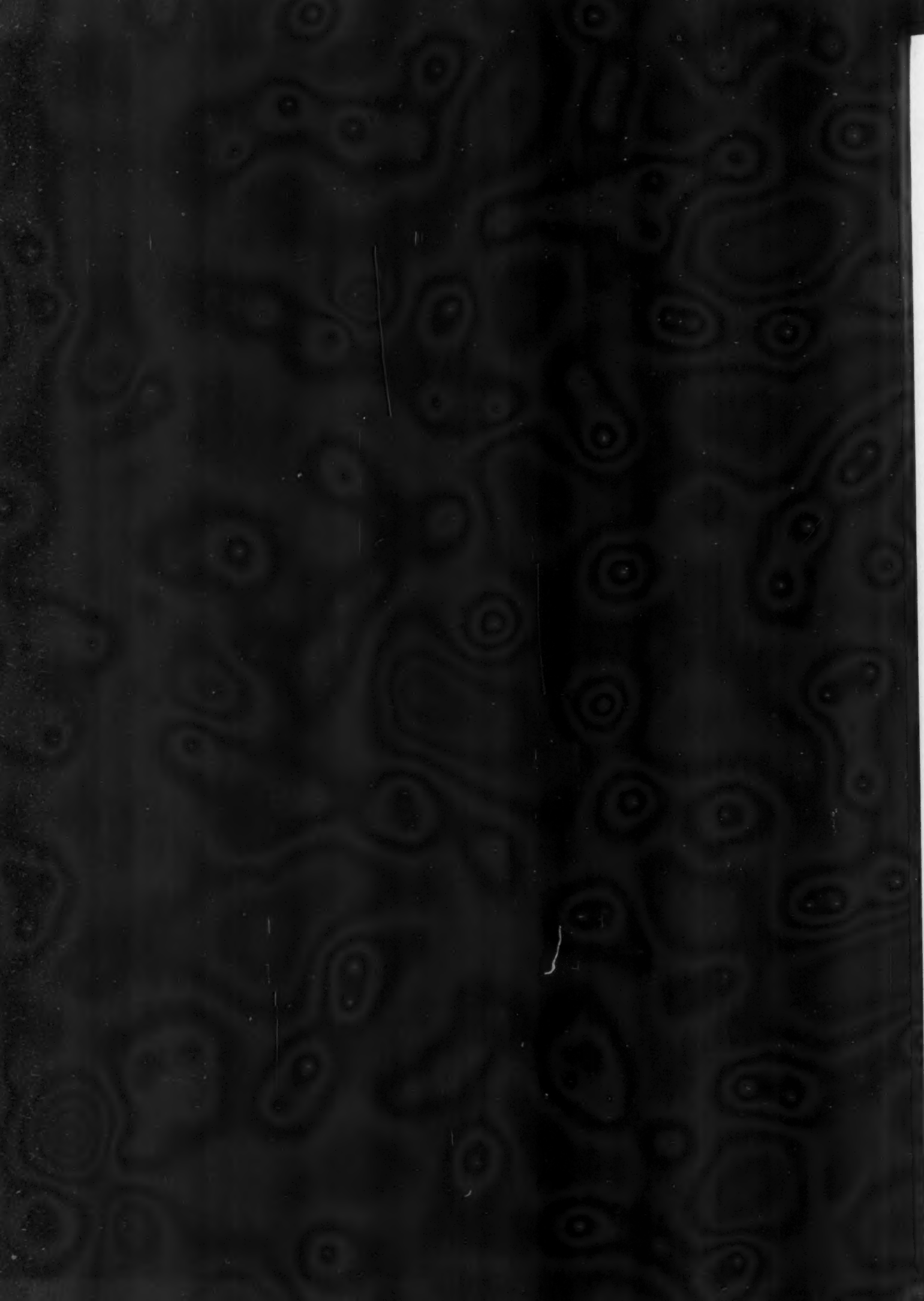

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Use the handy FREE service cards for additional information on this month's new products or for copies of latest trade catalogs.

NEW PRODUCTS & MATERIALS

See pages 120-126, 148-152

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Medium Power Relay.....page 120
Thermal Demand Meters.....page 120
Relief Valves .....page 120
Panel Instruments .....page 120
Rotary Pressure Joint.....page 120
Cylinder Opener .....page 122
Crane Control .....page 122
Pipe Cutter .....page 122
Portable Emergency Light.....page 122
Gas Generator .....page 122
Voltage Regulator .....page 122
Electrode .....page 124
Motor Control Center.....page 124
Heavy-Duty Relay .....page 124
Extension Bar .....page 124
Heavy-Duty Oil .....page 124
Tinning Pencil .....page 124
Time Lag Fuse .....page 124
Oil-Tight Pilot Light.....page 126
Ceiling Sprinkler .....page 126
Manual Reset Timer .....page 126
Solderless Wire Connector.....page 126
Coal Cleaner .....page 126
Gauss Meter .....page 126
Positioner .....page 126
Bending Bar .....page 148
Industrial Paint .....Page 148
Deodorizing Cleaner .....page 148
Safety Goggle .....page 148
Reflector Lamp and Plug.....page 148
Vibration Dampener .....page 150
Oil Flusher .....page 150
Bucket Elevator .....page 152
Solderless Connector .....page 152

MANUFACTURERS' BULLETINS

See pages 162b-172

Air Conditioning, Heating, Refrigeration, Ventilating.....page 162b
Boilers and Auxiliaries.....page 162b
Electrical Equipment .....page 162b
Maintenance and Safety Equipment .....page 164
Maintenance Materials .....page 164
Materials Handling .....page 166
Metals and Alloys.....page 166
Meters and Instruments, Mechanical .....page 168
Piping, Fittings, Valves and Specialties .....page 168
Pumps .....page 170
Water Treatment .....page 170
Welding .....page 170
Other Equipment .....page 172

HOW TO ORDER ADDITIONAL DATA

Be sure to fill out, completely, one coupon for each item of information you order. (See sample, right.) This gives your request authority and helps the manufacturer to address your copy completely.

When you have filled out completely one space for each item of information you want, detach along the scored lines and drop the cards in the mail.

Example

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Your Title... Power Engineer

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Your Title.....

POWER, 330 West 42nd St., New York 18, N. Y. 8/48

AIR CONDITIONING, HEATING, REFRIGERATION AND VENTILATING

1 **CENTRIFUGAL BLOWERS** — Industrial Div, Bryant Heater Co, 1020 London Rd, Cleveland 10, Ohio. Bulletin No. 6A-4, covers a complete line of lightweight Hi-Flo centrifugal blowers. This bulletin includes photos, diagrams, capacity and dimensional tables for the complete series, and describes filter combinations for operation in difficult locations.

2 **CENTRAL HEATING**—Dept 58C, RicwiL Co, Union Commerce Bldg, Cleveland, Ohio. 12-page brochure, Form No. 4713, entitled "Pittsburgh's Great Institutions Join Forces for Central Heating," gives a detailed account of how a group of cultural, educational and medical institutions cooperated effectively to achive a practical central heating system covering an extensive area in Oakland district of Pittsburgh.

3 **MODERN FANS** — National Assn of Fan Manufacturers, 5-208 General Motors Bldg, Detroit 2, Mich. 16-page booklet, entitled "Fresh Air—At The Touch of a Switch," is a story of modern fans and today's cheap electricity, told in headlines and pictures.

4 **PNEUMATIC ATOMIZING NOZZLES** —Spraying Systems Co, 4021 W Lake St, Chicago 24, Ill. Catalog No. 23 discusses selection of correct pneumatic atomizing nozzle for any spraying requirement.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ **UNIT HEATERS** — Young Radiator Co, Racine, Wis. 16-page catalog No. 2648 describes a new line of circular Vertiflow unit heaters. This catalog includes diagrams, performance data and similar information.

5 **SPRAY POND EQUIPMENT** — Water Cooling Div, Binks Mfg Co, 3114 Carroll Ave, Chicago 12, Ill. 4-page bulletin No. 13 discusses characteristics of spray pond systems.

6 **UNIT HEATER** — Thermobloc Div, Prat Daniel Corp, 74 Water St, E Port Chester, Conn. 8-page bulletin No. 300 gives informative data on Thermobloc unit heater, self-contained direct-fired unit only 30 in. in dia, with output of 550,000 Btu per hr.

BOILERS AND AUXILIARIES

7 **OIL-BURNING EQUIPMENT** — Peabody Engrg Corp, 580 Fifth Ave, New York 19, N. Y. 4-page bulletin No. 111 describes Peabody Types A and H oil burners with the wide-range mechanical atomizing feature. 4-page bulletin No. 205 discusses Peabody combination gas and oil burners. These bulletins carry cross-section blueprint drawings of both types of burners and Types A and AB wide-range mechanical atomizers.

8 **PACKAGE STEAM GENERATORS**— Foster Wheeler Corp, 165 Broadway, New York 6, N. Y. 4-page bulletin No. PG48-4 presents AG and AGH Series package steam generators. Photos, tables and diagrams are included.

9 **ANTHRACITE STOKER EQUIPMENT**—Anthracite Institute, 101 Park Ave, New York, N. Y. Booklet, entitled "How to Choose the Right Heating Equipment," discusses commercial anthracite stoker equipment, characteristics of the different types and data on performance.

10 **STOKER LINE**—Canton Stoker Corp, Canton, Ohio. Two 12-page bulletins show a line of stokers for all types of installations. One piece of literature presents data and photographs of installations of Canton's Duraflex model for medium-sized industrial applications. Second bulletin outlines advantages of Canton's heavy-duty Vulcan stoker for severe industrial applications.

11 **FURNACE INDICATOR** — Ess Instrument Co, 96 S Washington Ave, Bergenfield, N. J. Bulletin No. 441-B discusses Cat's-Eye furnace indicator. Bulletin No. SG-2 describes Ess Gravigage, an instrument for maintaining optimum specific gravity in a process. Bulletin No. 604 presents turbidity recorder TR-6. Bulletin No. AC-2 covers Ess air conditioning smoke detector, Model AC-1. Bulletin No. 801 is on the Ess Hazegage combustion indicator.

12 **COAL-PULVERIZING AND BURNING EQUIPMENT** — Advertising Dept, Babcock & Wilcox Co, 85 Liberty St, New York 6, N. Y. Bulletin covers coal-pulverizing and burning equipment for industrial furnaces and for steam generation. The development and application of such equipment is described and the text is illustrated with diagrams and photographs.

13 **SMALL BOILERS**—Kewanee Boiler Corp, Kewanee, Ill. 4-page catalog No. 92 gives ratings, specifications and measurements of Kewanee Round R steel heating boilers for small buildings.

ELECTRICAL EQUIPMENT

14 **INDUCTION MOTORS** — Technical Data Dept, Elliott Co, Jeannette, Pa. 4-page bulletin No. PB7000-2 describes new Fabri-steel squirrel-cage induction motors. Nineteen illustrations and one line drawing show distinctive construction details.

15 **AC GENERATORS**—Columbia Electric Mfg Co, 4519 Hamilton Ave, N. E., Cleveland 14, Ohio. 4-page bulletin section No. 800 discusses Columbia high-speed revolving field type synchronous ac generators.

16 **FLOAT SWITCHES** — Automatic Control Co, 1005 University Ave, St. Paul 4, Minn. Bulletin No. 2050 covers a new line of closed tank float switches, Types LC-200 and LCF-200.

17 **GEARED MOTORS**—U. S. Electrical Motors, Inc, 200 E Slauson Ave, Los Angeles 54, Calif. 16-page bulletin discusses use of geared motor power in driving machinery. This bulletin presents latest electrical motor models.

18 **INDUSTRIAL BATTERIES**—Gould Storage Battery Corp, Trenton 7, N. J. Folder describes Gould motive power batteries and the company's modern research laboratory.

19 **THERMAL FUSES**—Jefferson Electric Co, Bellwood, Ill. Folder No. 482-ST gives features of the new Jefferson Saf-T-Lag thermal fuse. Also included is a complete table of sizes on Knife-Blade and Ferrule types.

20 **GENERAL-PURPOSE MOTORS** — Allis-Chalmers Mfg Co, Milwaukee 1, Wis. 12-page publication No. 51B6052J, entitled "Handy Guide for Quick Selection of Electric Motors," provides detailed

(*Continued on page* 164)

FIRST CLASS
PERMIT No. 64
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3485

110

PC

ALLOY PIPE·BENDERS must be *Fine Craftsmen, also*

3485

After science has done its best, the dental technician must be a skilled craftsman to produce dentures with which the patient can eat comfortably.

Metallurgy and engineering are indispensable in setting up alloy pipe bending procedures . . . but it takes a skilled craftsman to follow them. Maintenance of wall thickness . . . minimum flattening . . . avoidance of wrinkles . . . maintenance of metal quality . . . application of the bending force . . . all require very high skill acquired only by long experience. Many alloys should not be water quenched . . . it makes them hard and brittle. Others may be partially quenched without harmful effects.

Qualified Pipe Fabricators recognize the importance of craftsmanship in alloy pipe bending. Their benders are men of long experience who do nothing else and use all available technical aids. This is just one reason why "Prefabricated Piping Is Better Piping."

P.F.I. THE PIPE FABRICATION INSTITUTE

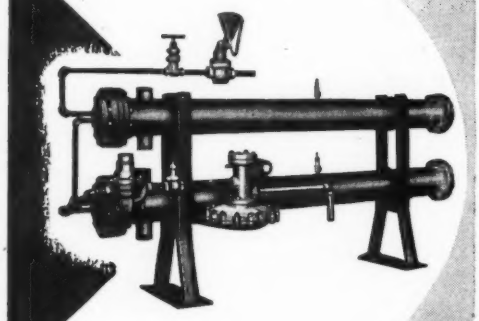
THE PIPE FABRICATION INSTITUTE

Devoted to the Technical and Economic Problems in Piping

1108 CLARK BUILDING · PITTSBURGH, PA.

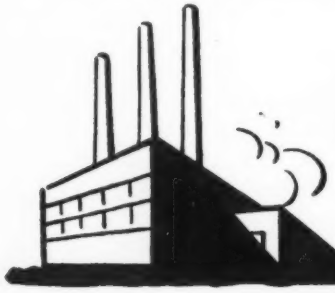
HENSZEY CONTINUOUS BLOWDOWN
will
INSURE
YOUR POWER PLANT

against
PRIMING
FOAMING
SCALE
SLUDGE



The Henszey System automatically keeps boiler water concentrations within safe margins — prevents foaming, priming, carryover and the formation of sludge and scale (with simple chemical treatment). This is accomplished continuously WITHOUT the HEAT LOSS of ordinary intermittent blowdown.

Maintain clean, efficient boilers with Henszey Continuous Blowdown for substantial savings in fuel, equipment and manpower . . . savings you need to hold down costs of production. Plan on a Henszey Continuous Blowdown System for your present — or future — power plant.



Consult your nearest HENSZEY representative or write to

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HENSZEY

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Boiler Feed Regulators • Distillation Systems • Heat Exchangers
Feed Water Meters • Flow Indicators • Proportioning Valves
also MILK EVAPORATORS and PREHEATERS

specifications covering squirrel-cage induction motors and application data, range of sizes and speed torque curves on synchronous, wound rotor and dc motors.

21 **ELECTRICAL WIRE AND CABLE** —Rockbestos Products Corp, New Haven 4, Conn. 96-page catalog and handbook No. 10-F gives complete line of more than 125 different heat and flame resistant wires, cables and cords of standard construction for severe operating conditions.

22 **MOTORS, GENERATORS** — Servo-Tek Products Co, 4 Godwin Ave, Paterson 1, N. J. Catalog No. 35 covers Servo-Tek line of ac and dc motors, servo motors, generators, autosyns, amplifiers, inverters, etc.

MAINTENANCE AND SAFETY EQUIPMENT

23 **TUBE CLEANERS** — Lagonda Div, Elliott Co, Jeannette, Pa. 4-page bulletin No. Y-26 describes air- and water-driven tube cleaners with swing frame cutter heads for cleaning boiler tubes and for general use.

24 **FIRE EXTINGUISHERS** — Ansul Chemical Co, Marinette, Wis. 20-page catalog discusses complete line of Ansul dry chemical fire extinguishers. Included is a pictorial explanation of the action that takes place when Ansul dry chemical comes in contact with flame.

25 **TUBE EXPANDERS** — Small Tools Dept, Gustav Wiedeke Co, Dayton 1, Ohio. Ideal bulletin No. 61 illustrates and lists adjustable tube expanders developed especially for rolling small tubes in thin, thick and multiple tube sheets of condensers, coolers, air conditioners, heat exchangers and similar units.

MAINTENANCE MATERIALS

26 **HEAVY-DUTY** — American-Marietta Co, 43 E Ohio St, Chicago 11, Ill. Main feature of power plant folder No. 7 is a chart giving correct primers and finish coats for every application in power industry.

27 **ROOF COATING**—Flexrock Co, Filbert & Cuthbert St, West of 36th St, Philadelphia 4, Pa. Folder presents Roofflex, a mineral asphalt that preserves new roofs, restores old roofs and in an emergency can be applied during a storm to seal a sudden damaging leak.

28 **LUBRICANT** — Sun Oil Co, 1608 Walnut St, Philadelphia 3, Pa. Booklet describes characteristics and applications of Sunvis 900 oil series. This booklet has a section on manufacture of the various Sunvis 900 oil grades that depicts step-by-step the refining processes involved.

29 **PISTON PACKING** — Worthington Pump & Machinery Corp, Harrison, N. J. 4-page bulletin No. W-404-B3 gives construction features of Worthington cup type piston packing.

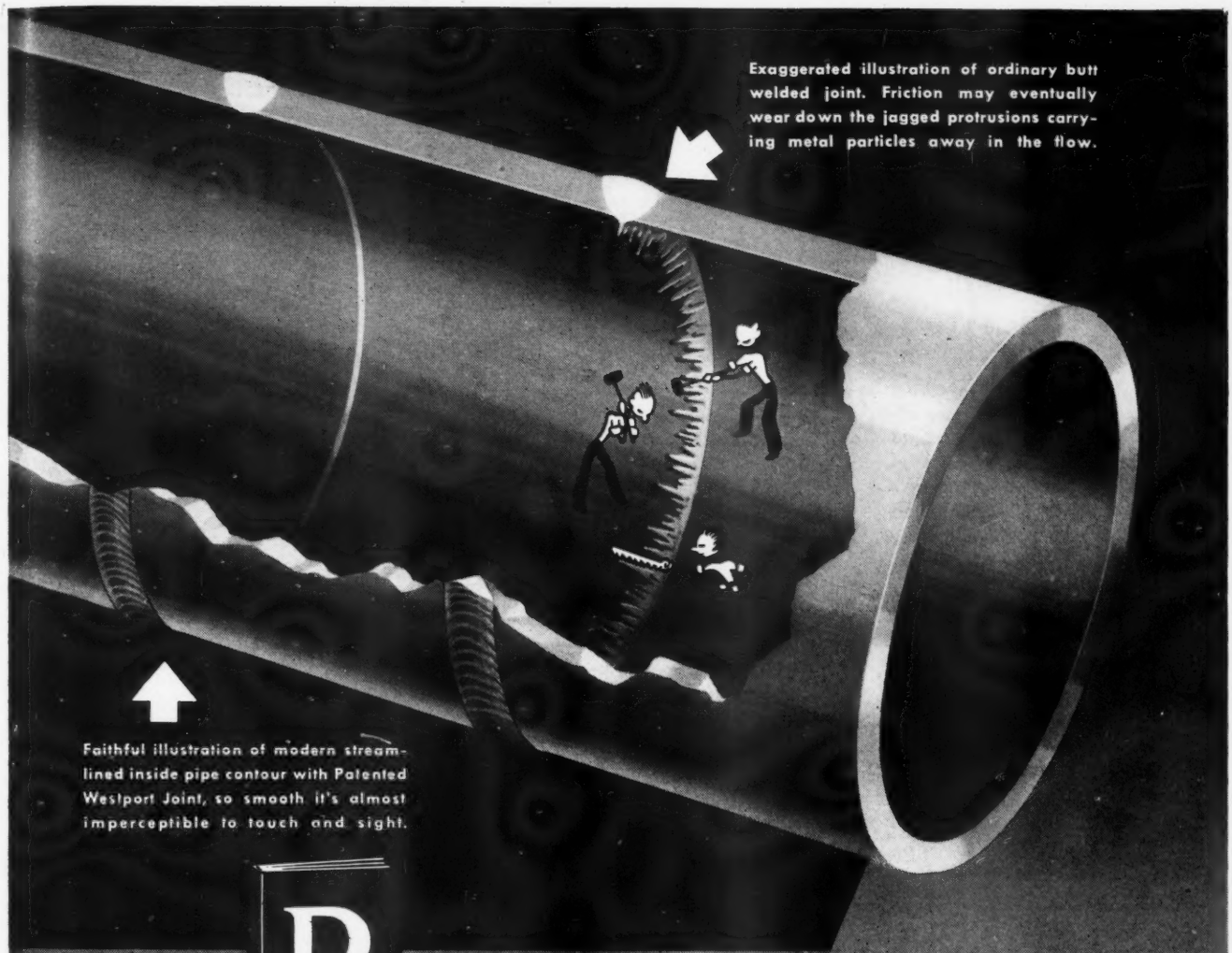
30 **RE-REFINING OF LUBRICANTS**—Retrol Div, Filtrol Corp, 634 S Spring St, Los Angeles 14, Calif. 26-page booklet discusses profitable methods of re-refining of lubricants.

31 **INTERIOR PAINT**—Vita-Var Corp, Newark, N. J. Folder outlines advantages of using Vita-Lux enamel.

32 **CHEMICAL RESISTANT COATINGS**—Morton Chemical Co, Greensboro, N. C. 6-page folder describes Duramite line of chemically inert paints and coating materials.

33 **FLOOR RESURFACER** — Dept P, Stonhard Co, 403 N Broad St, Philadelphia 8, Pa. Maintenance manual, entitled "Over the Rough Spots," discusses how you can patch holes and ruts or resurface any type floor simply and quickly.

34 **PACKING** — Parker Appliance Co, 17325 Euclid Ave, Cleveland 12, Ohio. 12-page catalog No. 901 describes Parker synthetic rubber O-rings. Dimension and selection tables cover 88 ring sizes, and list gland, cylinder bore, piston groove and piston rod diameters for each size.

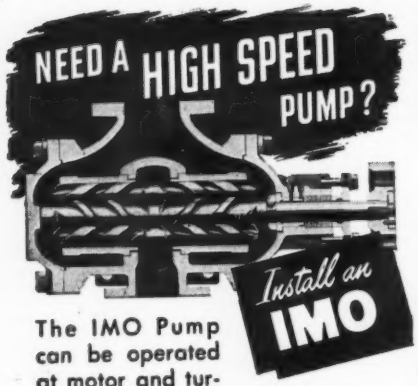

Exaggerated illustration of ordinary butt welded joint. Friction may eventually wear down the jagged protrusions carrying metal particles away in the flow.
Faithful illustration of modern streamlined inside pipe contour with Patented Westport Joint, so smooth it's almost imperceptible to touch and sight.

Like Books, Welded Pipe Joints Can't be Judged by their Outside Looks

Some of the smoothest looking jobs of butt welding you've ever seen would give you the creeps, if you could see the inside of the pipe joint. We've exaggerated the icicle-like protrusions of weld metal which result when no backing rings are used, but we haven't exaggerated the smoothness of the Westport Joint. And remember, while pipe ends can be recessed to lessen the inside humps caused by backing rings, this reduces the wall of the pipe. . . . The Westport Method of Controlled, Two Stage Welding assures inside pipe contours smoother than the best outside weld you've ever seen and further, bondage and strength are maximum. . . . Our bulletin "Something New in Welding" tells the complete story. Write for it today.

Pre-fabricated Carbon & Alloy Steel Piping and Installation Service, Anywhere • Westport and any other type of joint • Representatives in Boston, New York, Cleveland, Mobile, Los Angeles and Havana.

MITCHELL



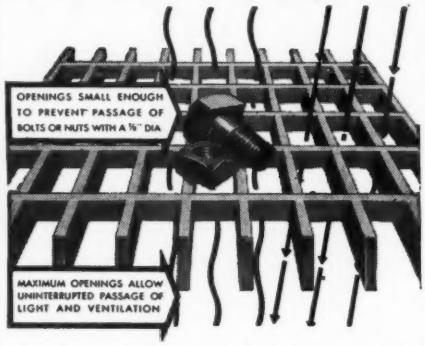
The IMO Pump can be operated at motor and turbine speeds. It is ideal for direct connection and integral mounting. Excepting for the flow and vaporization characteristics of the fluid being pumped, there's practically no limit to the speed at which an IMO Pump can be operated.

IMO Pumps can be furnished for practically any capacity and pressure required for oil, hydraulic-control fluids and other liquids.

Send for Bulletin 1-147P

IMO PUMP DIVISION of the
DE LAVAL STEAM TURBINE CO.
TRENTON 2, NEW JERSEY

TRI-LOK RECTANGULAR OPEN STEEL FLOORING


OPENINGS SMALL ENOUGH TO PREVENT PASSAGE OF BOLTS OR NUTS WITH A ½" DIA
MAXIMUM OPENINGS ALLOW UNINTERRUPTED PASSAGE OF LIGHT AND VENTILATION

Tri-Lok strength is obtained by truss action through twisted cross-bar, curved in opposite directions at each bearing-bar. Standard openings in Tri-Lok Rectangular Steel Flooring are 1" x 3⅞"—other size openings can be supplied as required.

Diagonal, or Super-Safety U-type Flooring, and stair treads of all types, are available. Bulletin KF 1140 describes the construction features of Tri-Lok Open Steel Flooring.

DRAVO CORPORATION

National Distributor for the Tri-Lok Company

Dravo Bldg., Pittsburgh 22, Pa.

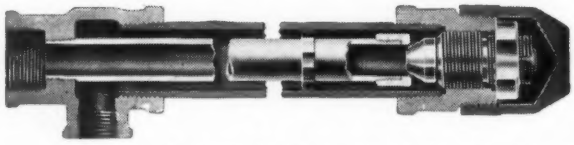
Sales Representatives in Principal Cities

DRAVO

Nicholson Expansion Steam Traps Solve . . .

"SLOW HEAT-UP"

Due to Air Binding



MANY APPLICATIONS

This widely used Nicholson trap is applicable to all equipment using steam or hot water for heat or power, for example:

Radiators
Separators
Paper Machinery
Pipe Coils
Kettles
Railway Coaches
Dry Kilns
Vulcanizers
Switch Heaters
Laundries
Plastic Molding Presses

Among the features of this simple and widely adaptable trap is its positive action. Closes tight when steam is in trap, opens wide when cold, rendering it proof against freezing and air-binding. Adjustable valve for passing condensate at any desired temperature. Pressures: 0 to 250 lbs. without change of valve or seat. Length: 18" to 40".

TRAPS FOR EVERY PURPOSE — power, heat, process. Weight and piston-operated traps for steam, air and gasoline pressures to 1500 lbs.; thermostatic steam traps, pressures to 225 lbs.; radiator traps, pressures to 15 lbs. CATALOG 448.

W. H. NICHOLSON & CO.

125 OREGON STREET, WILKES-BARRE, PA.

Manufacturers of Steam Specialties for Over 75 Years

35 RUST PREVENTIVE COMPOUNDS — Dept 29, Freedom-Valvoline Oil Co, Freedom, Pa. 14-page booklet gives general information on 23 removable rust preventive compounds.

36 PACKING—Crane Packing Co, 1800 Cuyler Ave, Chicago 13, Ill. 8-page bulletin contains tabulations of compound specifications, dimensional standards and data on applications, installations, etc, plus drawings showing typical problems of O-ring usage.

37 AIR-DRYING COATING — Lithgow Corp, 333 W 40th Pl, Chicago 9, Ill. 4-page folder describes LC-600 air-drying synthetic resin coating. Outstanding advantages are given.

MATERIALS HANDLING

38 COAL CAR DUMPER—Heyl & Patterson, Inc, 55 Water St, Pittsburgh 22, Pa. 6-page folder discusses operation of Heyl & Patterson Car-a-Minute coal car dumper.

39 PNEUMATIC CONVEYING SYSTEMS—Convair Corp, 508 Third Ave, Pittsburgh 19, Pa. 8-page bulletin No. 101 gives advantages of Convair pneumatic conveying systems. Diagrams are included.

40 ELECTRIC HOISTS — Lisbon Hoist & Crane Co, Lisbon, Ohio. 8-page bulletin introduces additional models to Bob-Cat electric hoist line.

41 MATERIALS HANDLING SYSTEMS—Allen-Sherman-Hoff Co, 225 S 15th St, Philadelphia, Pa. 8-page catalog No. 448, entitled "Hydrovac Materials Handling Systems," describes construction of this equipment.

42 MAGNETIC SEPARATOR — Dings Magnetic Separator Co, 4740 W McGeogh Ave, Milwaukee 14, Wis. Data sheet gives special features, typical applications and a table of dimensions and capacities covering the new Dings Alnico Perma-Pulley magnetic separator.

43 BALL BEARING MOUNTING—Advertising Dept, New Departure Div, General Motors Corp, Bristol, Conn. 20-page booklet AP outlines principal steps required in developing a successful ball bearing mounting.

44 FLEXIBLE COUPLINGS — Industrial Products Div, B F Goodrich Co, Akron, Ohio. 4-page index contains data on all the flexible couplings for direct-connected drives handled by B F Goodrich Co.

45 ADJUSTABLE SPEED DRIVES — Reliance Electric & Engrg Co, 1088 Ivanhoe Rd, Cleveland 10, Ohio. 8-page bulletin No. 311 covers latest developments in all electric, adjustable-speed drives for ac circuits.

46 GEARMOTORS — Link-Belt Co, 307 N Michigan Ave, Chicago 1, Ill. 16-page catalog No. 1815 describes double and triple reduction units with integrally mounted electric motor, in standard sizes of 1 to 30 hp, with an output speed range of 280 to 6 rpm.

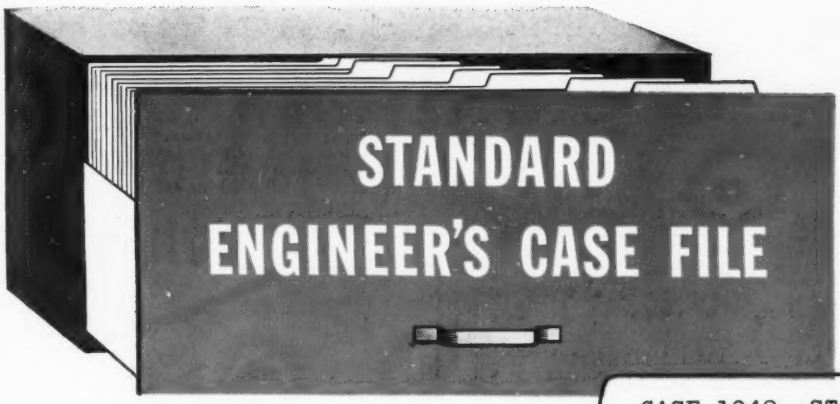
47 SPEED CHANGERS — Electric Machinery Mfg Co, Minneapolis 13, Minn. 20-page booklet No. 4400-TEC-1078, entitled "Precision Speed Control for Boiler Draft Fans with the Regutron Controlled Magnetic Drive," discusses principles of operation with graphs, diagrams and installation pictures.

48 BELTING LINE—Dept 107, Buckner Process Co, 544 Main St, Worcester 8, Mass. 6-page folder gives functions and scope of Lion Paw brand conveyor belting, transmission belting and safety matting.

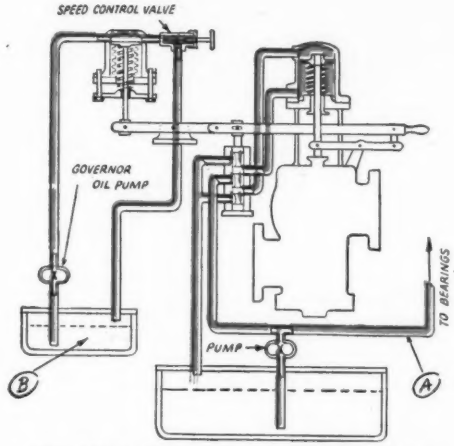
49 TIMING BELT—L H Gilmer Co, Tacony, Philadelphia 35, Pa. 6-page folder presents the new Gilmer timing belt. This belt makes positive engagement with the pulleys.

METALS AND ALLOYS

50 STAINLESS STEEL — Duriron Co, Dayton 1, Ohio. 8-page bulletin No. 112 discusses Durimet 20, a high alloy low carbon austenitic stainless steel.



CASE 1048—STOPPING RUSTING, LACQUERING, SLUDGING IN STEAM TURBINES.



VARIABLE-SPEED OIL-RELAY GOVERNOR

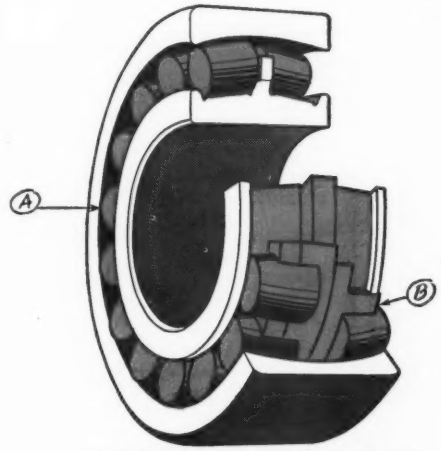
Charges of inhibited Calol OC Turbine oil in various size turbines gave service many times longer than normally obtained with straight-mineral oils. Use in large and small units ... ring-oilers, circulating oil lubricating systems and oil-actuated governor relay systems. Comes in four grades: 9, 11, 15, 19.

A. Contains highly effective corrosion inhibitor and has excellent metal-wetting ability. Keeps moisture in oil systems from contacting metal.

B. Oxidation inhibitor resists deterioration of oil and sludge formation caused by heat, moisture, air, dirt ... prevents plugging of oil lines.

Calol OC Turbine Oil in regular service showed no increase in acidity after several years ... turbine parts remained in same condition as when installed ... water and solid contaminants separated readily from oil in centrifuging or filtering systems.

CASE 1050--PROVIDING FLUID LUBRICATION IN ANTI-FRICTION BEARINGS WITHOUT LEAKAGE.



HEAVY-DUTY ROLLER BEARING

Heavy-duty industrial roller bearings started easier and ran freer when lubricated with Calol Grease BRB-340. Specially-made for all anti-friction bearings. Apply with grease gun or by packing.

Has unusual ability - softens around roller and balls in bearings to oil-like viscosity but remains firm on outer parts. Resets quickly so oil swept aside by moving bearing parts keeps firm outer seal of grease intact.

A. Soft consistency around moving parts of bearings lowers starting torque and reduces internal friction.

B. Firm grease forms seal that helps prevent leakage.

High resistance to deterioration under high speed conditions and extreme temperatures provides exceptional lubrication over extended periods of operation.

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The California Oil Company
30 Rockefeller Plaza, New York 20, N. Y.

The California Company
17th and Stout Streets, Denver 1, Colo.

Standard Oil Company of Texas
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DUCTS, HOPPERS •
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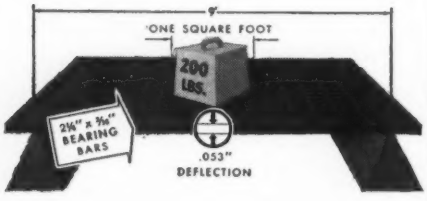
Branch Offices: New Orleans, Dallas, Denver.

For **STRENGTH** specify

TRI-LOK

RECTANGULAR

OPEN STEEL FLOORING



The locked-in strength of Tri-Lok enables it to stand up under heavy loads—even on long spans. No rivets, bolts, or welds are used in the construction of Tri-Lok; this feature eliminates the possibility of loose joints.

Tri-Lok is also available in Diagonal, or Super-Safety U-type Flooring, and in Stair Treads of all types. Write for Bulletin KM 1140.

DRAVO CORPORATION

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Dravo Bldg., Pittsburgh 22, Pa.

Sales Representatives in Principal Cities

51 STAINLESS-STEEL FASTENINGS —Anti-Corrosive Metal Products Co, Castleton-on-Hudson, N. Y. 4-page folder covers stock of stainless-steel fastenings that are available from the company.

52 BRONZE ALLOYS — Ampco Metal, Inc, 1745 S 38th St, Milwaukee 4, Wis. 16-page bulletin No. 95 covers Ampco line and gives information on a wide range of bronze products and alloys.

53 HIGH-TEMPERATURE ALLOYS— Haynes Stellite Co, Kokomo, Ind. 87-page book, entitled "Haynes Alloys for High-Temperature Service," contains all the available data on Haynes alloys that have been compiled by National Defense Research Council, National Advisory Committee for Aeronautics and prominent manufacturing concerns.

METERS AND INSTRUMENTS, MECHANICAL

54 MECHANICAL FLOWMETERS — Hagan Corp, 323 Fourth Ave, Pittsburgh, Pa. 12-page bulletin No. 2M48 describes Ring Balance mechanical flowmeters, Series 2200-2600. Dimensions and capacities are included.

55 CONSTRUCTION MATERIALS FOR CORROSIVE FLUIDS — Dept 6G-L, Fischer & Porter Co, Hatboro, Pa. 4-page engineering bulletin No. 97 gives detailed recommendations on construction materials for almost 400 different corrosive liquids and gases. Material recommendations are listed under three headings that have particular reference to Flowrator instrument construction features.

56 FLUID METERS—Bailey Meter Co, 1050 Ivanhoe Rd, Cleveland 10, Ohio. 40-page booklet No. 301-B, entitled "Bailey Fluid Meters for Steam-Liquids-Gases," discusses flow mechanisms, primary elements, integrators, auxiliary recorders, accessories and installation features.

57 ROTAMETER LINE—Brooks Rotameter Co, P O Box B19648, Lansdale, Pa. Catalog covers full line of rotameters for flow-rate measurement and control. Capacity chart, data sheet and dimension prints of each type of meter are included.

58 FLUE GAS ANALYZER — Instrument Div, Davis Emergency Equipment Co, 45 Halleck St, Newark 4, N. J. 4-page bulletin No. 1136A presents the company's newest development—the Davis continuous indicating and recording flue gas analyzer.

59 ELECTRIC PANEL TACHOMETER —Crown Industrial Products Co, 1509 E 53rd St, Chicago, Ill. Single sheet describes Crown electric tachometers for accurate, continuous speed measurements.

PIPING, FITTINGS, VALVES AND SPECIALTIES

60 PLUG VALVES—Ampco Metal, Inc, Milwaukee 4, Wis. 4-page bulletin No. 91 gives design features of corrosion-resistant plug valves. One page is devoted to engineering drawings that show various sizes of valves.

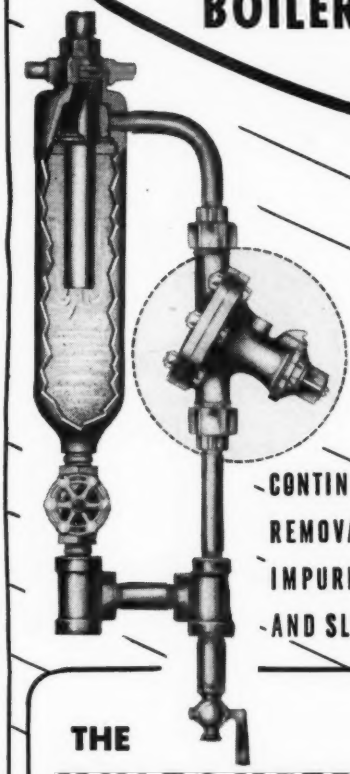
61 BRONZE GATE VALVES—Lunkenheimer Co, Cincinnati 14, Ohio. 12-page circular No. 534 presents a new line of union bonnet bronze gate valves. Tables of dimensions are also given.

62 EMERGENCY TRIP VALVES — Schutte and Koerting Co, 12th and Thompson St, Philadelphia 22, Pa. 4-page bulletin No. 8-D on engine stop systems describes and illustrates technical data on emergency trip valves and auxiliary equipment designed to operate by either mechanical or electrical means.

63 DESUPERHEATER LINE—Schutte and Koerting Co, 12th and Thompson St, Philadelphia 22, Pa. 8-page bulletin No. 6-D contains data on SK venturi type desuperheaters, SK surface absorption type and SK spray type, together with diagrammatic drawings and pertinent technical data.

64 WELDED FLOATS—W H Nicholson & Co, 12 Oregon St, Wilkes-Barre, Pa. 8-page bulletin No. 348 features welded floats of stainless steel, monel and chrome-plated steel, in spherical, elliptical and cylindrical shapes.

the *ONLY* *RIGHT WAY* to BLOW BOILERS



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Not just a blow-off valve, easily clogged or worn, but a complete scientific system for continuous, measured control of concentration in boiler water. Stops wet steam, foaming and priming. Proven record in hundreds of plants. Fits all boilers and feedwaters.

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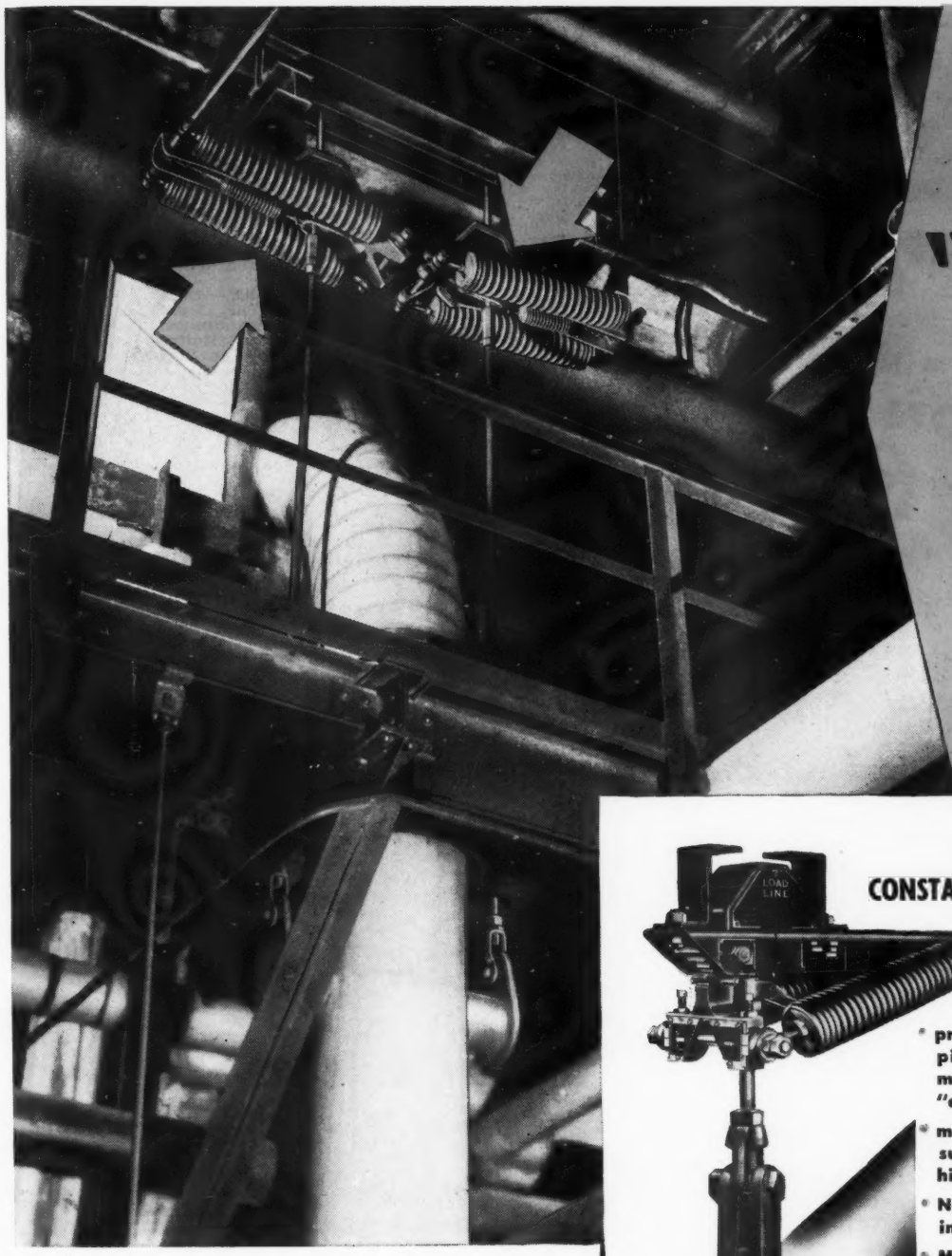

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● In one of the largest catalytic cracking plants for gasoline, Grinnell Constant-Support Hangers provide constant support for trunnion-supported vertical piping weighing 8,000 lbs. with 4" vertical movement at 1100° temperature.

Write for data book, "Grinnell Constant-Support Hangers", containing complete details.

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the ONLY constant-support pipe hanger

- provides constant support to piping subject to vertical movement—in all "hot" and "cold" positions.
- maintains full safety factor in supporting high temperature, high pressure piping.
- Non-resonant, energy absorbing.
- Mass-produced from standard precision parts.
- Individually calibrated for each installation.
- Load-adjustment features incorporated into design.
- Three models meet entire range of load-travel specifications.
- Minimum headroom required.

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WHENEVER PIPING IS INVOLVED

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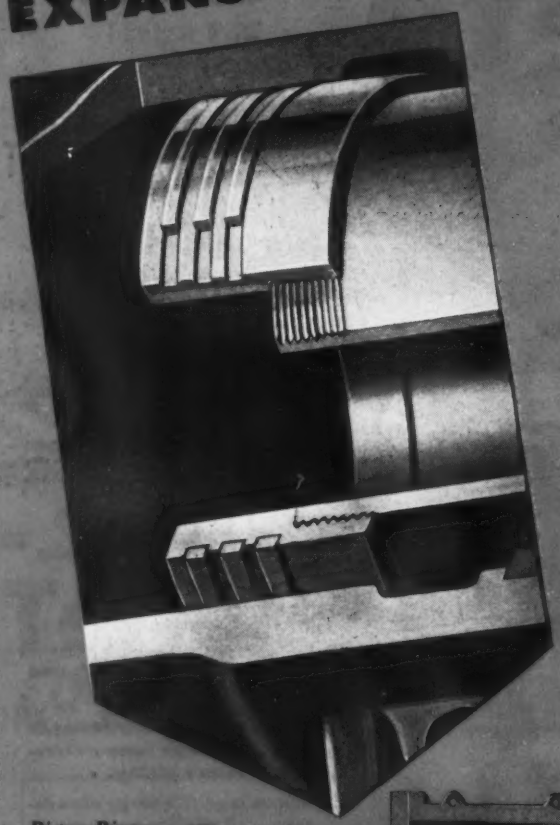
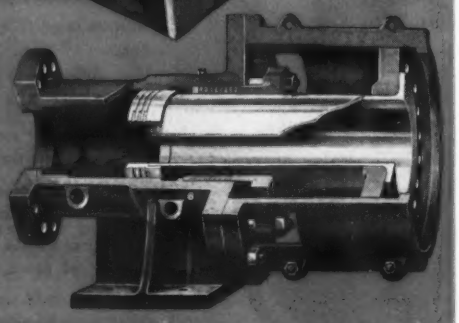
PISTON-RING EXPANSION JOINTS



Piston Rings hold the line pressure



● The outstanding joint of the decade. Fully guided. Can be packed under pressure. No shutdown for servicing. Packing lubricated in a jiffy. Write for Bulletin 35-15

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65 FLEXIBLE HOSE — Titeflex, Inc, 595 Frelinghuysen Ave, Newark 5, N. J. 24-page catalog describes Titeflex all-metal flexible tubing. Photos, diagrams and tables are included.

PUMPS

66 SINGLE-STAGE CENTRIFUGAL PUMPS—De Lavel Steam Turbine Co, Trenton 2, N. J. 28-page bulletin No. 83-29 presents outstanding features of De Laval single-stage centrifugal pumps. Pump ratings and dimensions are given.

67 PUMP LINE—Aldrich Pump Co, Allentown, Pa. 12-page catalog, data sheet No. 67, contains complete details on Aldrich inverted Multuplex pumps, including the Aldrich Triplex, Quintuplex, Septuplex and Monuplex.

68 CHEMICAL PUMPS — Milton Roy Co, 1305 E Mermaid Rd, Philadelphia 18, Pa. 8-page technical paper No. 57 discusses automatic chemical feed systems, their applications and how they function.

WATER TREATMENT

69 DE-OILING APPARATUS—Lawson Products Corp, 39 Broadway, New York 6, N. Y. 6-page booklet presents de-oiling apparatus for removing oil and oil emulsions from boiler feedwater or from water used in other similar industrial processes.

70 SLIME AND LIME-SCALE CONTROL — Oakite Products, Inc, 22 Thames St, New York 6, N. Y. Service report describes how a simplified method of water treatment with a specialized chemical material provides an effective answer to trouble arising from slime formation and lime-scale deposition on coils and other surfaces of evaporative condensers, coolers, humidifying systems and certain types of air-conditioning equipment.

71 ION EXCHANGE MATERIALS — National Aluminate Corp, 6220 W 66th Pl, Chicago 38, Ill. Section 1 of new booklet is a general discussion of ion exchange principles, with diagrams, formulae and illustrations of basic ion exchange reactions and typical uses. Section 2 gives technical data on each of the commercially available types of ion exchange materials sold and serviced by Nalco. Section 3 contains brief notes on a number of chemical manufacturing and processing operations employing ion exchangers.

72 WATER SOFTENERS, DEALKALIZERS, PRECIPITATORS — Permutit Co, 330 W 42nd St, New York 18, N. Y. 12-page bulletin No. 2418 discusses Permutit Zeo-Karb water softeners and dealkalizers. 12-page bulletin No. 2204 gives operation and design of the Permutit Spaulding precipitator.

WELDING

73 ARC WELDING — Hobart Brothers Co, Troy, Ohio. Vest-pocket guide gives characteristics of various welding arcs, four essentials of proper welding procedures, type of joints, typical positions, chart of standard steel shapes, photographs of good and bad welds, causes of common welding troubles and what to do about them, welding symbols and an easy-to-use table of "How to Find" formulas.

74 ARC-WELDING ELECTRODES — Dept A19-24P, Air Reduction Sales Co, 60 E 42nd St, New York 17, N. Y. Pocket guide presents all the facts pertaining to the most commonly used Airco electrodes, along with helpful data regarding the factors to be considered when choosing an electrode for a specific job.

75 WELDING RODS—Eutectic Welding Alloys Corp, 40 Worth St, New York 13, N. Y. 4-page bulletin No. AM-30 contains concise information on outstanding welding rods for use in every shop.

76 ARC-WELDING ELECTRODES — Ampco Metal, Inc, 1745 S 38th St, Milwaukee 4, Wis. Bulletin No. W-19 consists of a chart that gives recommended arc welding electrodes for joining like or dissimilar metals.

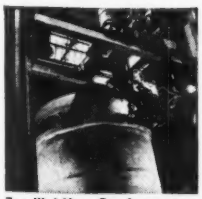
Metallurgical Research conducted continually by recognized specialists who have made major contributions in this field.

Unique Technical Backing of an extensive organization with an international reputation in both process and fabrication engineering.

Complete Facilities for the fabrication of steel products from simple forgings to the most intricate 120 foot towers.

Quality Control embracing the constant application of the most advanced inspection methods, both visual and non-destructive.

On-Time Delivery made possible by a flexible planning group authorized to re-route work to meet promised dates.



Top Welding Performance assured by specially designed equipment and exclusive employment of master operators.

When is the best time to judge the quality of power piping?

Here is a pipe bend for a power installation—about to start on its way to you.

For its intended service, steel of the correct analysis has been specified. It has been welded under laboratory supervision and radio-graphed. It has been bent hot, with careful temperature control—*no water quenching!* And finally it's been properly heat-treated. To all intents and purposes, it is the best power-piping that money can buy.

But *is* it? That you can't tell *until it's hooked up to your equipment, ready to play its part in the steam line.*

To make the erection job match shop fabrication in quality, controls must be extended to the *job site.* Because here, stresses *set up during field welding* can produce metallurgical faults *which can affect seriously the life of both piping and connected equipment.*

For instance, knowing exactly where to apply support to piping—and how much to apply—during field welding and heat treating is one of the important control factors.

To assure that this and many other necessary precautions are taken during erection of power piping, we here at Kellogg have *integrated* our field installation service with both our shop and metallurgical laboratory staffs—providing both experienced erection technicians and the latest metallurgical know-how at the most important spot: *the job site.*

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VESSELS • EXCHANGERS • CONDENSERS • HIGH PRESSURE AND HIGH TEMPERATURE POWER PIPING
PROCESS PIPING • FORGED AND WELDED FITTINGS . . . IN ALL STEELS, ALLOYS OR SPECIAL COMBINATIONS

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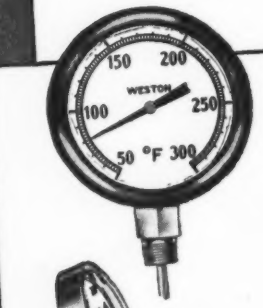
HUMIDITY INDICATOR
by Weston

- **Quick-reading**
- **Convenient**
- **Accurate**

Simplified Slide Rule Calculator gives relative humidity readings directly—eliminates charts and tables. Entire unit ruggedly constructed of metal, including the two Weston dial-type thermometers, providing readings accurate to ±1% for general conditions.



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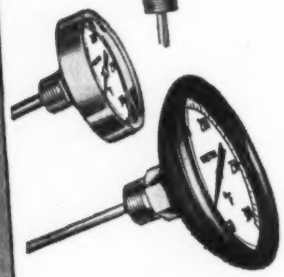
ALL-METAL
THERMOMETERS

Featuring readability, reliability and rugged construction. Available in models for industrial applications in required stem lengths and ranges; also models for laboratory use.



Available through distributors, or consult your local WESTON representative.

WESTON *Instruments*

Weston Electrical Instrument Corporation
617 Frelinghuysen Avenue, Newark 5, N. J.

77 **WELDING GUNS** — Progressive Welder Co, 3050 E Outer Dr, Detroit 12, Mich. 12-page technical bulletin No. 402 shows, in text and illustrations, how the company's new standardized welding guns are built up by combining standardized and interchangeable components.

OTHER EQUIPMENT

78 **SILICONE PRODUCTS** — Chemical Dept, General Electric Co, Pittsfield, Mass. 30-page bulletin No. CDR-57 describes new GE silicone resins, oils, greases, water repellents and rubber, together with their many industrial uses.

79 **AIR COMPRESSORS**—Davey Compressor Co, Kent, Ohio. Bulletin describes new departmental system of industrial air compressor operation. Installation diagrams and photos are included, together with complete departmental specifications.

80 **INTAKE AIR FILTERS**—Dollinger Corp, Rochester 3, N. Y. 8-page bulletin No. SIF describes complete line of Staynew dry-type intake air filters for all kinds of air compressors, diesel and gas engines, blowers, motors and generators.

81 **BOILER WATER LEVEL CONTROL** — Northern Equipment Co, Erie, Pa. 8-page bulletin No. 479 discusses boiler water level control at St. Regis Paper Co.

82 **LIQUID COOLERS** — Heat-X-Changer Co, 415 Lexington Ave, New York 17, N. Y. Page presents Heat-X-Changer liquid coolers for boiler blowoff, water sampling and other applications. Capacity curves are given.

83 **INSULATING BLOCK** — American Structural Products Co, Ohio Bldg, Toledo 1, Ohio. 4-page folder describes properties and advantages of Kaylo heat insulating block.

84 **DIESEL ENGINE**—Hercules Motors Corp, Canton, Ohio. 28-page booklet, entitled "Hercules Diesel Engines—General Information," gives explanations of pertinent basic characteristics and functions of this type of engine and clarifies many of the commonly asked questions about these prime movers and the fuel and oils they use.

85 **STEAM TURBINES** — Worthington Pump and Machinery Corp, Harrison, N. J. 24-page bulletin No. 1961 describes construction of Type S multistage steam turbines.

Aluminum Co of Canada will make a $100,000 preliminary engineering survey of Bute Inlet area on British Columbia coast some 180 miles north of Vancouver to determine power resources and site possibilities for establishment of a plant comparable to its $300 million plant at Arvida, Quebec. Bute Inlet area, involving the undeveloped Chilko-Taseko lakes power system 40 miles back in mountains at head of the inlet, is one of three the company is considering and, according to a survey by government water engineers, could produce about 1,083,000 hp.

R E Powell, president, after inspecting the area at the end of May, said the company would undertake the preliminary survey before going ahead with a full engineering survey that would take about two years at a cost of one million.

Inspections will also be made of two other sites, at Dean Channel, 350 miles north of Vancouver, and Gardner Channel, 450 miles north, near Prince Rupert. Power site of Dean Channel area is the Eutsuk-Kimsquit lakes system, capable of producing 910,000 hp, while Tahtsa-Kemano system, at head of Gardner Channel, can supply about 845,000 hp.

UNION "O" TYPE BOILERS

ONE OF 13 TYPES COVERED *in this book*

THE UNION TYPE "O" BOILER is particularly adapted to oil or gas firing as the tube curvatures provide a large furnace volume and side wall water walling without using headers or circulating tubes.

They are low in cost since the pressure element consists of a single upper and lower drum.

Compactness and absence of dead gas pockets have been secured without sacrificing performance, accessibility or ease of cleaning.

These units can be installed with settings constructed of refractory or tile insulation and steel casing.

Write Union Iron Works, 881 Cascade St., Erie, Pa. for booklet on Union's 13 basic boiler designs.

UNION IRON WORKS • ERIE, PA.

Since 1890

BOILERS — PROCESS EQUIPMENT — FABRICATED STEEL

SCREWED-END STRAINER
FLANGED-END STRAINER
YARWAY
IRON
"Pipeline Policemen"
A good strainer protects your equipment and pipeline.
These little Yarway "guardians of the pipelines" have literally taken industry by storm. In the few years since their introduction, hundreds of thousands have been bought . . . are daily giving top satisfaction in a variety of services.
HERE ARE SOME OF THE REASONS:
SCREEN—a high-grade woven monel wire basket that catches solids—lets condensate, oil or other fluids flow freely. Perforated screens if desired.
SCREEN CAP—easily removed. Cap and screen come out together. Screen automatically aligns when replaced. Machined face and spark-plug-type gasket provide tight joint.
BODY—rugged iron or steel, cadmium-plated for protection against corrosion and for better appearance.
SIX SIZES—½" to 2" for pressures up to 600 lbs.
AVAILABILITY—stocked and sold by 150 Mill Supply Houses. Reasonably priced.
See your local dealer or write for Bulletin S-201.
YARNALL-WARING COMPANY
100 Mermaid Avenue Philadelphia 18, Pa.
YARWAY STRAINERS
"Police the Pipelines"

Appointments

(*Continued from page* 162)

Corp, with its main office at the plant, 286 Scholes St, Brooklyn 6, N. Y. Robert G Pitz has been elected president, and Eugene Hahn vice-president and general manager.

Marley Co announces change of its Los Angeles office to 810 S Spring St. Harold A Dresser has joined the Los Angeles sales dept.

John W Crossett has joined development and research div of **International Nickel Co,** at N. Y. Crossett will follow railroad development work, in which he succeeds the late Frederick P Huston.

Weston Electrical Instrument Corp, Newark, N. J., has announced appointment of three new representatives to cover Texas and Okla: (1) Butler and Land, 3405 Milton Ave, Dallas, for north Texas (2) Lynn Elliott Co, 322 M & M Bldg, Houston, for south Texas (3) Riddle and Hubbell, 302 S Cheyenne Ave, Tulsa, for all of Okla.

Edward Enthof has joined Chicago office of **Sweet's Catalog Service,** of F W Dodge Corp, as a catalog consultant.

Westinghouse Electric Corp has elected D W R Morgan, of Philadelphia, and John K Hodnette, of Sharon, as vice-presidents, and E V Huggins, of New York, as secretary. Ralph R Brady has been appointed manager of commercial engineering for lamp div, Bloomfield, N. Y. Brady succeeds the late D W Atwater.

J J Stephens has been made president of **Strong, Carlisle & Hammond Co,** Cleveland, Ohio. He has been also re-elected treasurer. He succeeds G J Zimmerman, who retired last Dec.

Airetool Mfg Co, Springfield, Ohio, has named Herbert A Russell, engineer, to head branch office in Philadelphia.

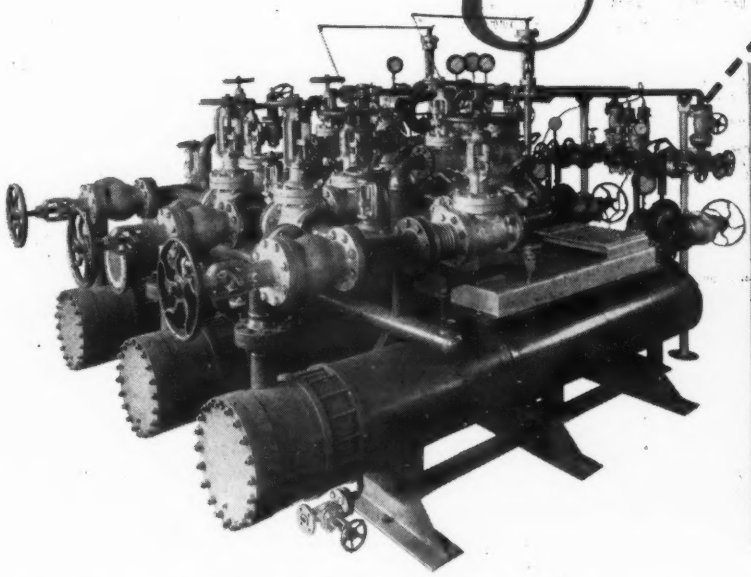
W F Sewert becomes manager of hardware products for **Wickwire Spencer Steel Div,** Colorado Fuel and Iron Corp. He continues to operate from 500 Fifth Ave, New York 18, N. Y.

Lincoln Electric Co announces election of W R Persons, general sales manager, and K F Steingass, superintendent electrode manufacture, to board of directors. Both men had been members of junior board of directors.

A G Stoughton has been elected chairman of board as well as president of **Midwest Piping & Supply Co,** St. Louis, Mo. Office of board chairman was vacated recently through death of Hugo F Urbauer. Walter R Mayne, St. Louis attorney, has been made a director.

Economy Pumps, Inc, announces opening of a new sales office in Chicago at 105 W Monroe St, with Beldon S Tucker dis-

World's Largest



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PUMPING AND HEATING UNIT

.....*"tailor made"* by

ENCO

This 150 gpm fuel oil pumping and heating unit—the biggest ever built—was engineered and built by Enco for a large steel corporation. One motor and two turbine driven pumps, cross connected with three heaters, furnish fuel oil at desired temperature, pressure, and volume to three boilers producing well over 1,000,000 lbs. of steam per hour. One pump and one heater are always available as spares.

The design and performance of all Enco fuel oil pumping and heating systems from the smallest to the largest ever built provide tangible proof of Enco's skill in the field of pre-combustion preparation of fuel oils. Write for bulletin O B-37 or see your local Enco Representative for details on Enco oil burning, pumping and heating equipment to fit *every* boiler room requirement.

EC-475

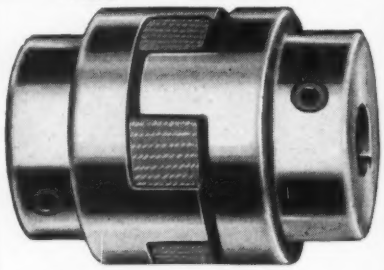
THE ENGINEER COMPANY

75 WEST STREET, NEW YORK 6, NEW YORK

Canadian Representative: F. J. Boskin, Ltd.
4220 Iberville St., Montreal 34, P.Q.

10 PLUS FEATURES
That Highlight ENCO'S Superiority

- COMPLETELY AUTOMATIC OPERATION is assured by automatic temperature and pressure regulation valves.
- COORDINATED DESIGN SAVES SPACE. All equipment essential to the preparation of fuel oil for combustion is contained in one compact unit.
- INDIVIDUALLY DESIGNED to meet the specific needs of the particular power plant in accordance with its exact operating requirements.
- ALL PARTS VISIBLE AND ACCESSIBLE for easy operation, maintenance and repair.
- PUMPS AND HEATERS are interconnected to provide maximum flexibility of operation.
- SAFETY VALVES protect individual parts where required.
- EASIER MAINTENANCE — LESS SERVICE-TIME FOR CLEANING because straight tube, multi-pass heaters with removable heads are used.
- PUMPS OPERATE AT MODERATE SPEED. Heaters designed to give the correct viscosity and velocity without fouling.
- SMOOTHER FLOW OF CLEAN FUEL TO FURNACE. Air chamber for each piston pump prevents pulsations — pressure regulator for rotary pumps. Twin type strainers provided to keep atomizer tips from clogging.
- CLEANER BOILER ROOM . . . all overflows connected to a common outlet; flanged drip pan catches oil drip.



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FLEXIBLE COUPLINGS
are
Job-Fitted

The cushion material in the type "A" coupling is one of 4 standard types developed to take up shock, dampen vibration, and correct misalignment. Specials can be had for unusual applications. With the wide range of Lovejoy types, fitted with the right cushion material for your particular application, we can provide you with the coupling you need.

WRITE TODAY FOR LOVEJOY CATALOG AND SELECTOR CHARTS TO AID IN YOUR SELECTION.

LOVEJOY FLEXIBLE COUPLING CO.
Mfrs. of Lovejoy Variable Speed Transmissions
5070 W. Lake Street, Chicago 44, Illinois

Makes ALL VALVES *INSTANTLY* Accessible

CONTROL FROM THE FLOOR

● Instant, handy, safe control of overhead and other out-of-reach valves. Eliminate danger to employees; banish the stepladder. Now — install valves anywhere they should be, regardless of accessibility.

Inexpensive BABBITT Sprocket Rims fit all types and makes of valves, with either rising or non-rising stems. Installed quickly by clamping directly onto hand wheel of valve. Eliminates makeshift apparatus and specially-made chain wheels.

● Ten standard sizes take care of all valve wheels from 2 to 30 inches in diameter.

● *Request Catalog Bulletin P; prices, name of local distributor:*

Babbitt — Adjustable — SPROCKET RIM with Chain Guide

BABBITT STEAM SPECIALTY COMPANY
New Bedford, Mass. U.S.A.

ALLPAX the PACKING *that never sticks . . .*

ALLPAX is the packing that does the packing job *right.* You can use it advantageously on hot or cold liquids or gases and be assured of a leak-tight, scoring-free service which will save you time and money in maintenance. Because of its field of application, ALLPAX is a *universal* packing.

ALLPAX never sticks because it is compounded in such a way as to prevent it. Thin flakes of anti-friction metal and tiny scales of graphite are imbedded all through long, tough fibres of asbestos. To this is added a special non-liquid, heat-proof lubricant. Shafts and rods rotate or slide smoothly without scoring or sticking.

ALLPAX is available in various diameters for a wide range of stuffing box sizes and is easily cut to exact length required and slipped into place without waste. Available also in loose form for general service.

A trial of ALLPAX will quickly convince you that ALLPAX is the packing for your packing jobs. Your nearest distributor can supply you.

THE ALLPAX COMPANY, INC.
Mamaroneck, N. Y.

trict sales manager. Bruce Hetler is new Economy distributor for western Mich., with headquarters at Grand Rapids.

Walter Geist has been elected to his seventh term as president of **Allis-Chalmers Mfg Co.** All directors and officers were re-elected at the annual meeting. J C Armor has been promoted to consulting engineer at Pittsburgh works.

Leeds & Northrup Co, Philadelphia, announces retirement of Felix Wunsch, a veteran of engineering staff and inventor of numerous circuits widely used in electrical measuring instruments, after nearly 43 years with the company. Paul V Roth, since 1919 shop engineer, has retired after nearly 46 years of service with the company.

Charles H Johnson has been appointed manager of marine dept of **Combustion Engrg Co,** New York City. G H Kuechler has been made assistant manager of export div.

Thomas C Wilson, Inc, Long Island City 1, N. Y., has appointed five new sales representatives covering western Texas, N. M. and Ariz., Iowa and eastern Neb., S. C. and western N. C., eastern Tenn. and lower peninsula territory in Mich. The new representatives are: (1) Steel & Engrg Products, 311 Mills Bldg, El Paso, Texas (2) Interstate Machinery and Supply Co, 1006 Douglas St, Omaha 8, Neb. (3) Plibrico Sales and Service Co, Box 1084, Charlotte, N. C. (4) Leinert Engrg Co, 412 E 5th Ave, Knoxville, Tenn. (5) Kiger Supply Co, 2842 W Grand Blvd, Detroit, Mich.

Thermoid Co has elected Carl Brockway a vice-president.

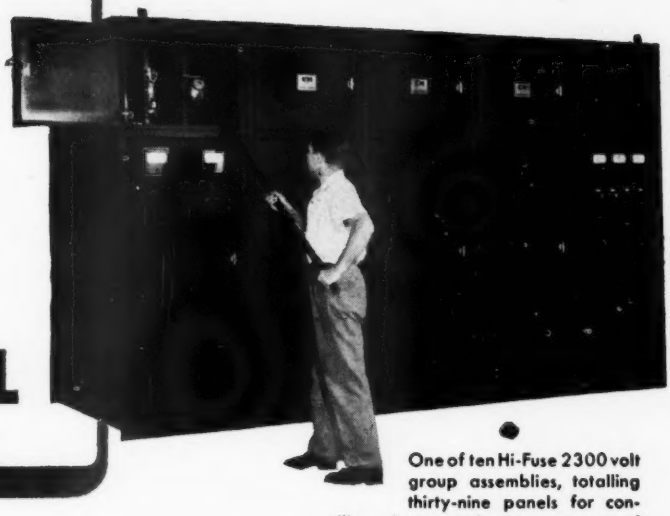
Charles W Mackett has been appointed manager of sales operations for **Hewitt Rubber Div,** Hewitt-Robins, Inc., Buffalo, N. Y. In his new position he will direct all home office sales of the div.

George J Hartnett, general superintendent of Barberton, Ohio plant of **Babcock & Wilcox Co,** has retired after 35 years of service with the company. Cecil H Gay becomes works manager in charge of Barberton works and of Rust St plant at Alliance.

Babcock & Wilcox Tube Co, New York, N. Y., has elected Luke E Sawyer executive vice-president and a director. He takes over management duties following recent death of Peter D White, former president. Paul J Utnehmer has been named works manager in charge of manufacturing at Beaver Falls, Pa., and Alliance plants. Alfred Iddles, president of Babcock & Wilcox Co, the parent company, also has been elected president of the tube firm. Babcock & Wilcox Tube Co has appointed Industrial Supplies, Ltd, 744 Hastings West, Vancouver, as its exclusive sales agent for British Columbia, Canada.

West Penn Power Co, Pittsburgh, Pa., has appointed H D Panton mechanical engineer. D H Johnson, central div manager, with headquarters at Charleroi, will be retired at his own request as of Aug 31, having reached retirement age. J V Soisson

CHECK-REIN *for high-stepping* HORSE POWER WITH E-M "HI-FUSE" CONTROL



One of ten Hi-Fuse 2300 volt group assemblies, totalling thirty-nine panels for controlling sixteen induction motors and twenty-three synchronous motors at a southern paper mill.

HIGH-STEPPING horse power in today's industrial plants needs tight-reined control.

You can harness this rampant high-voltage with E-M "Hi-Fuse" Control for motors from 2300 to 4600 volts.

Horse-and-buggy day practice was to provide no short circuit protection. This was followed with a large, expensive, high-interrupting capacity switch. Contrast that with the new E-M "Hi-Fuse" Control system using the elements shown in the diagram at the right. "Hi-Fuse" does a thorough job of protecting and controlling your high voltage motors . . . "Hi-Fuse" costs you less. In every way, it's a better buy!

"Hi-Fuse" gives you these advantages:

SHORT CIRCUIT PROTECTION—current limiting type high interrupting capacity power fuses (up to 250,000 kva) cut off the short circuit current in a fraction of a cycle. Quick action saves motor and control from damage.

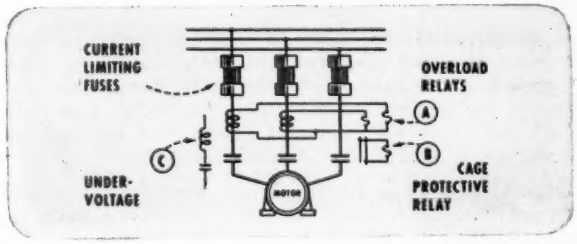
MOTOR PROTECTION—the current limiting fuses provide a means of disconnecting the motor from the line, as shown in the photo above. As the oil switch is not required to furnish short circuit protection, a smaller, less expensive switch is adequate. Coordinated with this switch and the fuses are overload and out-of-step relays to protect the motor from sustained overload, locked rotor, single phasing, under voltage, or too frequent starting.

POLARIZED FIELD FREQUENCY STARTING—in synchronous motors this "almost human" relay assures the highest synchronizing torque and minimum current in-rushing during starting. The Polarized Field Frequency system of starting was developed by E-M and for many years has been accepted as the best method of controlling the application and removal of field excitation of synchronous motors.

Here, then, is "Hi-Fuse" Control! It's the ideal system to give you the coordinated motor control you need in your plant! "Hi-Fuse" controls are available for both induction and synchronous motors, and are applicable generally without analysis of the short circuit current. For group assembly, both AC and DC buswork is provided. Segregated high and low voltage compartments and electrical interlocks help to provide for the safety of operators.

The "Hi-Fuse" Control unit is completely packaged ready for quick installation. It's attractive in appearance and strongly built. The doors are piano-hinged. Sturdy metal construction throughout.

Sum up what "Hi-Fuse" Control will do for you in your plant. You'll find it's the best buy for SURE protection and control of all your high voltage motors. Be sure to get full information about "Hi-Fuse" Controls NOW! Write for our technical bulletin 192.



●Simplified Connection diagram shows elements of protection provided for the motor in "High-Fuse" Control.

ELECTRIC MACHINERY MFG. COMPANY
MINNEAPOLIS 13, MINNESOTA

3100-TPA-2073

E-M

Specialists in
BIG MOTOR ENGINEERING

...to the City of Baltimore

BIG city operation requires the best equipment. That's why the carload of Zallea copper Self-equalizing Expansion Joints shown in the picture above are Baltimore bound, to be used in the Back River Sewage Treatment Works.

Installation is intended in the rotary distributor piping which lies deep in the filter beds of this disposal plant. This installation is typical of many jobs specially engineered by Zallea. In this case, because the sewage after being mixed with air is slightly corrosive to the corrugated copper elements, Zallea has wrapped each of the 14", 30", and 36" diameter joints in a bonded neoprene external coating—to add further to their long life.

Dependability and trouble-free performance are built into *every* Zallea Expansion Joint. They *last,* even under the most severe conditions.

Zallea Corrugated Expansion Joints are made in non-equalizing, self-equalizing, and duo-equalizing types, depending upon operating conditions . . . of copper, stainless steels and corrosion-resistant alloys . . . up to 72" diameter for a wide range of temperatures and pressures. Send *now* for complete information contained in the new Zallea Catalog 47. ZALLEA BROTHERS, 814 Locust Street, Wilmington 99, Delaware.

Zallea
EXPANSION JOINTS

WORLD'S LARGEST MANUFACTURERS OF EXPANSION JOINTS EXCLUSIVELY

has been promoted to div managership of central div at Charleroi. R W Hurd has been promoted to western div manager. A R Newell becomes district manager at Charleroi. Realignment of districts in Keystone div has also been announced: Ridgway, Johnsonburg, Kane and Mt. Jewett are formed into one district to be known as Elk district. R O Rumbaugh has been promoted to district manager of Elk district, with headquarters at Ridgway. St Marys, Emporium and Coudersport are formed into one district, known as Sylvania district. J T Sarson has been promoted to managership of Sylvania district, with headquarters at St. Marys. C H Blackmore will be transferred to Kane district as local manager.

R S Cooper, system communications of **West Penn Power Co,** has retired. J G McKinley succeeds him. H F Atkins has been promoted to telephone engineer. Louise Baer, system traffic instructor at Connellsville, continues to assist Atkins and McKinley in studies of flow of telephone traffic over the system, and methods and facilities to keep this traffic moving in most efficient manner. R M Armstrong, of Charleroi, has been promoted to electronics engineer. He continues to serve as field engineer in installation, maintenance and testing of company-owned communication equipment. As facilities are made available, headquarters of communications group will move from Connellsville to Charleroi. McKinley will continue, however, to make his headquarters at Pittsburgh. H F Kelso will direct supervision of communications group for administrative purposes. His headquarters will be Charleroi. On communication matters only, Kelso will report to McKinley.

Adolph Hinrichs, formerly director of dept of public works, New Rochelle, N. Y., has been appointed structural engineer for **Wearm, Vreeland, Carlson and Sweatt, Inc,** power consultants and constructors, New York, N. Y.

Camie Jock has retired as manager of Hogansburg plant of **Central New York Power Co** after 43 years of service. He has had charge of the Hogansburg plant for 17 years.

Charles E Anderson, Charleston attorney, has been named to succeed John T Copenhaver as minority member of 3-man **West Virginia Public Service Commission.**

Union Electric Co of Missouri has appointed E R Kropp assistant to the president.

Edward W Norris has retired as mechanical engineer of **Stone & Webster Engrg Corp,** Boston.

Manning, Maxwell & Moore, Inc, New York City, has acquired the hydraulic div of Airex Mfg Co in Long Island City. Manning, Maxwell & Moore will develop industrial applications for Airex Hydraulics products in addition to present hydraulic line of Airex relief valves, other hydraulic valves, filters, and pneumatic pressurizing valves for aircraft industry. Airex Hydraulic operations will be carried on by Manning, Maxwell & Moore, Inc, at their

HERE'S HOW: When your problem is coal . . . switch to oil. When it's oil . . . switch to gas. When it's gas . . . switch back to coal! You can do this *in a matter of minutes* with the *Bros* Steam Generator.

This *Bros*-designed unit is specially built for quick, easy fuel conversion . . . switching from one fuel to another with a minimum loss of working time.

This amazing fuel flexibility has been achieved by *Bros* engineers in steam generating units fired by *Bros Travl-Spred* continuous ash discharge stokers and combination gas and oil burners.

It has given such concerns as the B. F. Nelson Mfg. Co., Minneapolis, control over fuel situations which formerly controlled them. This Steam Generating Unit is one of two 90,000 lb. installations which supply continuous power and process steam for the manufacture of asphalt shingles and other roofing products.

Similarly designed units can free you from the threat of short fuel supply . . . give you fuel flexibility to switch from solid to gas to liquid fuels easily and without loss of time.

For complete details on this *Bros* Steam Generator, write:

WM. BROS BOILER AND MFG. CO.
Minneapolis, Minnesota

Fabricators of Steel *Since 1882*

BROS

WATER TUBE, FIRE TUBE BOILERS • OVER FEED, UNDER FEED • HYDRAULIC-TRAVL-SPRED STOKERS

TROUBLE-FREE
KEWANEE
SCOTTIE JR
• For 6 to 30 H. P. at 100 lbs. W. P. Like a steel bridge you can't wear it down. Every part is accessible and it's easy to handle. Truly trouble-free and economical to operate. For Oil, Gas, Coal.
For 6" Scale with pipe diameter markings—WRITE Dept. 99-K8
KEWANEE BOILER CORPORATION
KEWANEE, ILLINOIS

WATCH FOR OCTOBER POWER

MODERN PLANT SURVEY

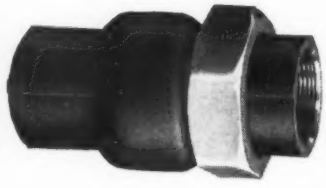
Design trends . . . plant descriptions . . . new installation lists

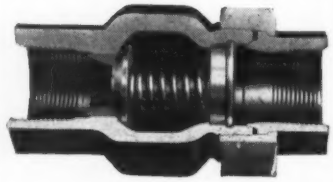
YOUR GUIDE TO TODAY'S POWER PRACTICE

Stop HAMMERING AND VIBRATION IN YOUR BOILER FEED LINES!

Here's how specify CATAWISSA SINGLE UNION SPRING CONTROLLED CHECK VALVES!

full view





cutaway view

- Positive Seating!
- Eliminate hammering and vibration!
- Easy access to all parts!
- Eliminate additional union and nipple!

For boiler feed lines and other applications requiring maximum dependability!

— RECOMMENDED FOR —

400-lbs. Working Steam Pressure
800-lbs. Pressure AOWG to 150° F.

Tested to 2000-lbs.
Non-Shock Hydrostatic Pressure

See your industrial supply distributor or WRITE DIRECT FOR BULLETIN 10-A

CATAWISSA VALVE & FITTINGS CO.
206 Mill St. • CATAWISSA, PENNSYLVANIA

Jersey City plant, 450 Communipaw Ave. Norman Collins, hydraulic engineer, with Airex Mfg Co, has joined Manning, Maxwell & Moore, together with other key Airex personnel.

H K Ferguson Co has retained Dr Henry W Newson as a full-time consultant on nuclear reactor design.

Lawrence Washington announces organization of **Washington Engrg Co,** 1075 Third St, Palo Alto, Calif., for consultation, product design and development, and laboratory testing in fields of air conditioning, heating and ventilation, refrigeration, and heat transmission.

Midwest Research Institute's engineering mechanics dept, under supervision of Martin Goland, will have following new members: Herbert Arenson, Malcolm R Easterday, Wallace Merit Yocum and Lawrence A Platt. Dr C L Shrewsbury, head of agricultural and organic chemistry dept, will have following new staff members: Dorothy B Powers and Harold Hale Branine.

Dr Harold Vagtborg, president and director of **Midwest Research Institute** at Kansas City, Mo., has announced to board of governors his resignation to permit him to accept appointment, effective Sept 1, 1948, as president and director of Southwest Research Institute based in Houston, Texas; as director of Institute of Inventive Research; and as director of Foundation of Applied Research; also as technical director of the 3500-acre Essar Ranch, all located just outside city limits of San Antonio, Texas. Dr George E Ziegler, executive scientist, will continue in that capacity and will also take over administrative responsibilities of Midwest Research Institute until Vagtborg's successor is announced.

Donald S Walker, vice-president of **Combustion Engrg Co,** New York City, has been elected to serve a second term as president of U. S. Naval Academy Alumni Assn.

C G Dandrow, vice-president of Johns-Manville Sales Corp and general sales manager of industrial products div, has been elected president of **Mass. Institute of Technology Alumni Assn.**

Columbia University has announced retirement of Professor Arthur W Hixson, executive officer of dept of chemical engineering. Professor Thomas B Drew succeeds him.

James B Morrow, first vice-president of Pittsburgh Consolidation Coal Co, has been elected president of **Bituminous Coal Research, Inc.** Morrow replaces Howard N Eavenson. Robert H Sherwood, president of Central Indiana Coal Co, Indianapolis, Ind., was elected first vice-president. The directors also elected R D Stockdale, president of Red Jacket Coal Sales Co to a vice-presidency and Dr Harold J Rose was re-elected as vice-president and director of research. Dr Charles E Lawall, assistant vice-president and engineer of

NEW PUMP DESIGN
Moves more liquid... *at less cost*

YOUR PROBLEM: To move a liquid from one place to another place—and do it cheaply. Your cost is important. It includes initial cost, installation cost, and maintenance cost. And you don't want breakdown costs.

GOULDS ANSWER:

The New "CLOSE-CUPLD" Centrifugal

ABOUT INITIAL COST: The initial cost is about the same as other quality pumps.

ABOUT INSTALLATION COST: All you do is set this compact pump in place, connect it up and turn on the current. That greatly reduces installation cost.

ABOUT MAINTENANCE COST: The new design is aimed at maintenance cost. There are 5 features in particular that stand out: 1. Completely protected shaft, 2. Completely protected motor bearing, 3. Shaft sleeve free to expand or contract without buckling, 4. For flexibility the machined stuffing box is designed for either mechanical seal or die formed, semi-metallic packing, 5. Split gland for fast stuffing box repacking.

ABOUT BREAKDOWN COST: The new "Close-Cupld" has proved itself outstandingly reliable in the toughest tests we could devise.

ABOUT YOUR PARTICULAR PROBLEM: Goulds "Close-Cupld" comes in 17 sizes . . . capacities to 2000 G.P.M., heads to 400 ft., depending on capacity. You can get "Close-Cupld" bronze fitted, all iron, or all bronze. You get prompt factory delivery, which means a "Close-Cupld" tailored to your particular job.

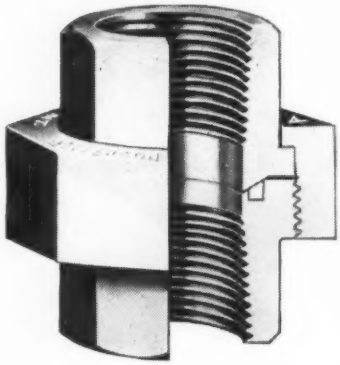
For one of these new pumps that moves more liquid at less cost, see your Goulds dealer or write to Goulds Pumps, Inc., Seneca Falls, N. Y.

GOULDS

PUMPS, INC.

the PUMP FOR the JOB

JEFFERSON UNIONS



. . . *feature the*

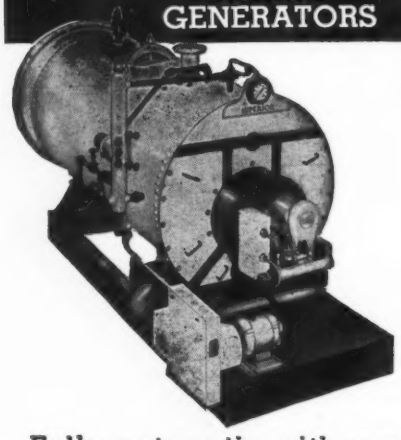
RECESSED BRASS SEAT

Leak-proof tightness without undue pressure in setting up is assured by this exclusive feature of *all* Jefferson Unions. Location of the Recessed Brass Seat is such that pipe ends cannot come in contact with it no matter how far pipe ends are screwed in.

Jefferson also makes a complete line of 45° and 90° Union Elbows and Union Tees. Your nearest distributor has further details or get in touch with us direct.

JEFFERSON UNION CO.
605 W. 26th St., New York 1, N. Y.
63 Gooding St., Lockport, N. Y.
39 Fletcher Ave., Lexington 73, Mass.

SUPERIOR STEAM GENERATORS



Fully automatic with any grade of oil. 17 sizes from 20 to 500 b.h.p. for pressures up to 200 p.s.i. Require no expensive chimney, supply their own induced draft. 80% thermal efficiency guaranteed. Write today for catalog 101.

Superior Combustion Industries, Inc.
Factory: Emmaus, Pa.
Executive Offices: Times Bldg., Times Sq., N. Y.

coal properties of Chesapeake and Ohio Railway Co, has been named permanent chairman of mining development committee.

J W McAfee, president, Union Electric Co of Missouri, has been re-elected president of **Missouri Assn of Public Utilities.** Other officers re-elected are: (1) *first vice-president*—H B Newman, president, Missouri Utility Co, Cape Girardeau (2) *second vice-president*—R D Green, president, Missouri Public Service Corp, Warrensburg (3) *third vice-president*—H B Munsell, president, Kansas City Power and Light Co.

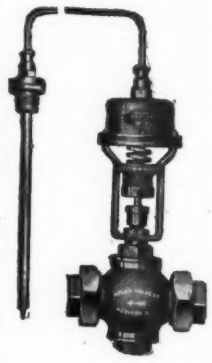
American Society for Quality Control has elected Ralph E Wareham as president for a one-year term. Wareham is vice-president and a director of National Photocolor Corp of New York. George D Edwards of Bell Telephone System is retiring president of the society. Other elected officers are: *vice-president*—W R Weaver of Republic Steel Corp in Cleveland; *executive secretary*—S Collier of Johns-Manville Corp in New York; *treasurer*—A L Davis of Rochester Institute of Technology in Rochester.

Dr Harold K Work, manager of research and development of Jones and Laughlin Steel Corp, Pittsburgh, has been nominated president of **American Society for Metals.** When elected, Dr Work succeeds Francis B Foley of Philadelphia, Midvale Corp executive. Dr Arthur E Focke, research metallurgist of Diamond Chain and Mfg Co, Indianapolis, Ind., has been nominated as vice-president of the society. W H Eisenman, present secretary, has been nominated for his 16th consecutive 2-year term in that office. Dr Harry Croft, director of technical control and research, Chase Brass and Copper Co, Cleveland, Ohio, and Frederick J Robbins, manager, Sierra Drawn Steel Corp, Los Angeles, Calif., have been nominated for 2-year terms as national trustees of ASM.

American Society of Mechanical Engineers has nominated James M Todd, New Orleans consulting engineer, as its next president. Nomination is tantamount to election as only one name is presented for each office. Following regional vice-presidents have been nominated: (1) Arthur Roberts Jr, chief engineer, Lynchburg Foundry Co, Lynchburg, Va. (2) Forrest Nagler, chief mechanical engineer, Allis-Chalmers Mfg Co, Milwaukee, Wis. (3) Carl J Eckhardt, professor of mechanical engineering and superintendent of utilities, University of Texas, Austin. (4) Albert R Mumford, development engineer, Combustion Engrg Co, 200 Madison Ave, New York (renominated). Following directors-at-large were nominated: (1) Jacob A Keeth, manager of power production, Kansas State Power and Light Co, Kansas City Kan. (2) Ralph A Sherman, assistant director, Battelle Memorial Institute, Columbus, Ohio.

John J Lincoln Jr, director of sales services, Air Reduction Sales Co, New York, has been elected president of **International Acetylene Association.** A J Fau-

TEMPERATURE ATLAS REGULATORS



BULLETIN No. 6-A illustrates and describes in full ATLAS Hydraulically and Pneumatically Operated Temperature Regulators for hot water heaters, storage tanks, cooking vats, retorts, ovens, kilns, pasteurizers, etc. A 20-page bulletin.

BULLETIN No. 7-A shows the ATLAS Self-Contained Vapor Type for Liquids, among which are those described below as well as others. A 16-page bulletin.

In other words, there is an ATLAS for every temperature regulating service.

ATLAS No. 650

Balanced Type Double Seat Valve. Spring Adjustment. For temperatures from 70° to 300° F. Bulb is immersed in liquid and control valve installed in steam supply. ½", ¾", and 1" for steam pressures up to 150 lb. 1¼", 1½", 2", and 2½" for steam pressures up to 100 lb. Operates in vertical or horizontal position.

ATLAS No. 651

Needle Type. Single Seat Valve. Spring Adjustment. For temperatures from 70° to 300° F. Used where tight seating valve is essential such as on small oil heater pump sets, open or closed tanks, sterilizers, glue heaters, etc. ½" and ¾" for steam pressures up to 150 lb. Operates in vertical or horizontal position.

ATLAS No. 655

Balanced Type. Double Seat Valve. Lever and Weight Adjustment. For temperatures from 70° to 300° F. Lever and weight adjustment of control valve assure high sensitivity. For maintaining temperature of liquids in all kinds of tanks and heaters. ½", ¾", and 1" for steam pressures up to 150 lb. 1¼", 1½", 2", 2½", 3", 4", 5", 6", and 8" for pressures up to 100 lb. Operates in horizontal pipes.

ATLAS No. 660

Single Seat Self-Contained Pilot Operated Valve. Spring Adjustment. For temperatures from 70° to 300° F. For use where accurate regulation demands a quick opening and closing control valve and where steam pressure is always 25 lb. or more, as for instantaneous heaters and tanks for water, oil, etc. ½", ¾", 1", 1¼", 1½", and 2" for steam pressures up to 300 lb. 2½", 3" and 4" for steam pressures up to 250 lb.

Other ATLAS Products:

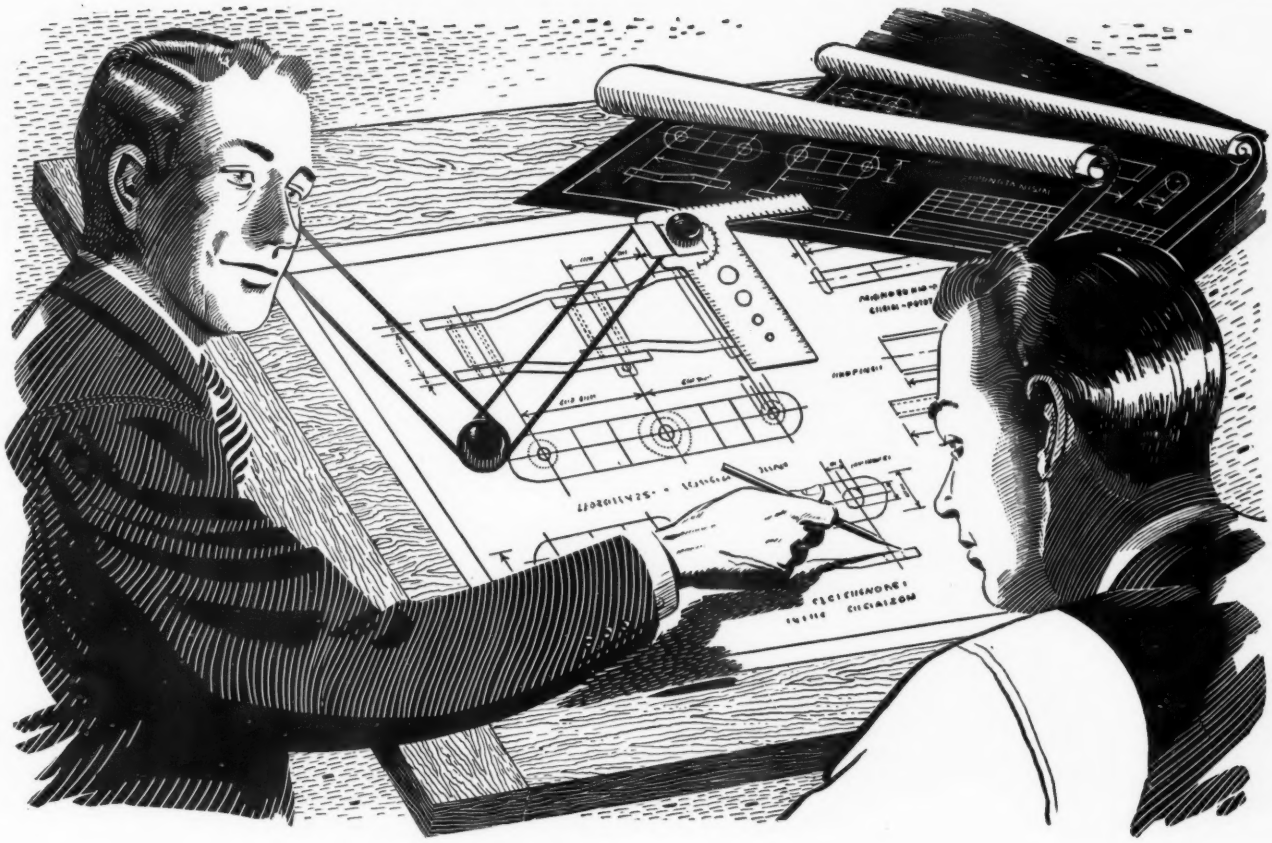
Check the items on which you would like to have data and mail to us with your name, firm name and address.

- ☐ Damper Regulators
- ☐ Temperature Regulators
- ☐ Reducing Valves
- ☐ Exhaust Control Systems
- ☐ CAMPBELL Boiler Feed Water Regulators
- ☐ Pump Governors
- ☐ Pressure Regulators
- ☐ Oil Control Cocks
- ☐ Humidity Controllers
- ☐ Thermostats
- ☐ Balanced Valves
- ☐ Control Valves

ATLAS VALVE COMPANY
REGULATING VALVES FOR EVERY SERVICE

289 South St. Newark 5, N. J.

Represented in Principal Cities



What's Interesting About UNION CHAIN'S Engineering?

Union Chains for Every Application

Drive and Conveying Chains and Sprockets

- Bridge Chain
- Combination Malleable Iron and Steel Chain
- HB (hardened bearing) type chain
- BP (bar and pin) type chain

★

Finished Steel Roller Chains and Sprockets

- All manufacturer's standard, size ⅜ in. to 2½ in. pitch
- Single and Multiple Strands
- Extended Pitch Series in sizes 1¼ in. to 4 in. pitch

★

Silent Chain and Sprockets

- All sizes ⅜ in. to 1½ in. pitch

★

Flexible Couplings

- Roller chain type
- Silent chain type

The Engineering Division of The Union Chain and Manufacturing Company devotes all its time and talent to a single objective: the most efficient and economical fabrication and application of sprocket chains and attachments for transmitting power and handling materials. We believe this technical specialization delivers a plus benefit to all our customers, both present and future, not the least of which is the ability of UNION CHAIN'S engineers to tackle successfully a challenging variety of unusual and difficult application problems.

The Union Chain and Manufacturing Company

TRANSMIT POWER
UNION CHAINS
CONVEY MATERIALS

Sandusky, Ohio, U.S.A.

IN OCTOBER POWER

•

MODERN PLANT SURVEY

•

Your guide to today's power practice:

1. **Summaries of design trends.**
2. **Concise descriptions of typical new industrial and utility plants.**
3. **Tabulations of technical highlights of new steam and hydro installations.**

WATCH FOR IT!

sek, president, Modern Engrg Co, St. Louis, has been made vice-president and E V David assistant manager of technical sales div, Air Reduction Sales Co, New York, has been named treasurer. H F Reinhard is re-elected secretary. R B Swope, president, Southern Oxygen Co, and retiring president of IAA, becomes a director. Henry Booth, vice-president of Shawinigan Products Corp, New York, and C McL Pitts, president, Peoples Gas Supply Co, Ltd, Ottawa, Ont., are re-elected directors for three years.

Nominations for officers of **American Society for Testing Materials** are: *President*—Richard L Templin, assistant direct of research and chief engineer of tests, Aluminum Co of America, New Kensington, Pa. *Vice-president*—L J Markwardt, assistant director, U. S. Forest Products Lab, Madison, Wis. *Members of board of directors*—Leslie C Beard Jr, chemist and assistant director of laboratories, Socony-Vacuum Oil Co, New York, N. Y.; Simon Collier, director of quality, Johns-Manville Corp, New York, N. Y.; Theodore P Dresser Jr, chief engineer, Abbot A Hanks, Inc, San Francisco, Calif.; Howard K Nason, associate director, central research dept, Monsanto Chemical Co, Dayton, Ohio; Edgar W Fasig, general superintendent, Lowe Brothers Co, Dayton, Ohio.

Edgar A Jett, II is named assistant director of Armour Research Foundation of **Illinois Institute of Technology.**

W G Christy, Hudson County, N. J. smoke abatement engineer, has been elected president of **Smoke Prevention Assn.**

OBITUARIES

Rudolf M Ostermann, 71, formerly vice-president of Superheater Co at Chicago, died at his home in Evanston, Ill. on May 4.

Joseph E Donahue, engineer of Rhode Island Tool Co, Providence, R. I. died in that city on April 28. He had been with the company 22 years.

Daniel Mitchell, 64, chief engineer of Lever Brothers plant, Cambridge, Mass. died at his home in Medford, Mass., on May 3.

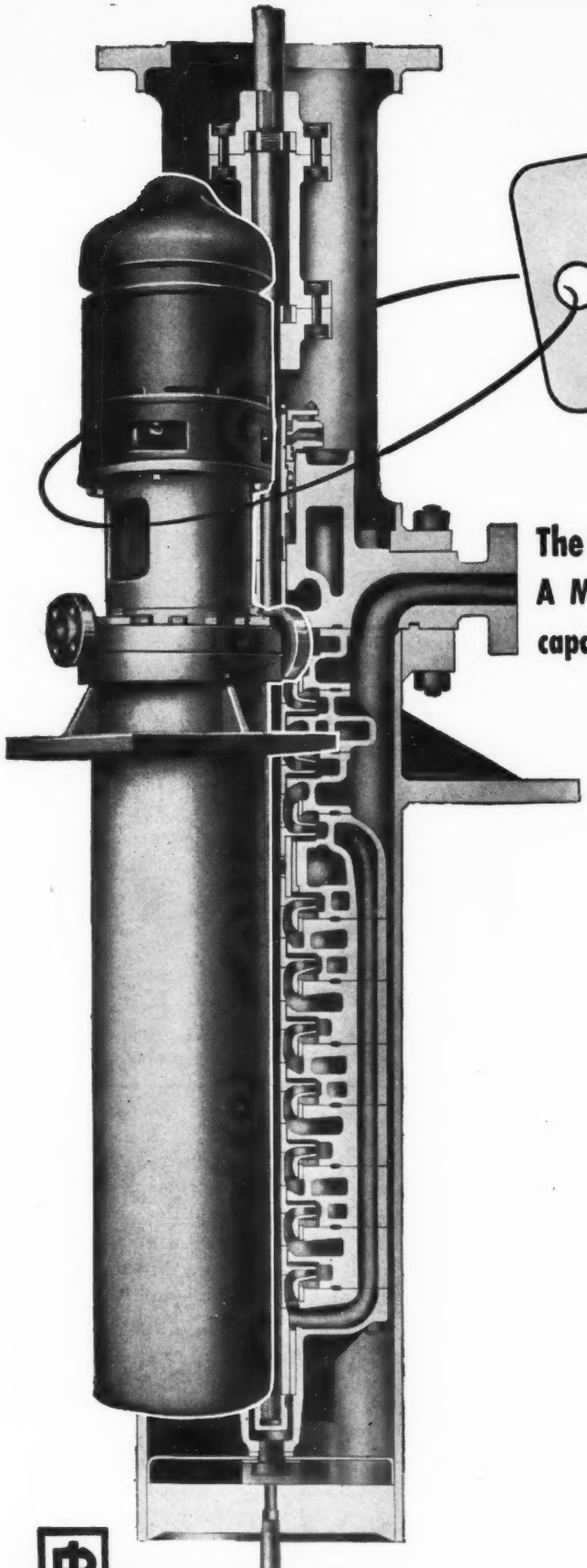
William J Lang, 62, stationary engineer for Bemis Bag Co, Buffalo for ten years, died May 3 in a Buffalo hospital.

John A Schmidt, 83, former chief engineer at Masten Ave Armory in Buffalo, N. Y., died May 9 after an illness of two years. He held the position 37 years before retiring.

Howard Ketchum Dutcher, 70, died at his Vancouver, B. C. home recently. He was a partner in firm of Dutcher, Brockington and Co. Dutcher was consulting engineer of many of B. C.'s largest power developments.

George Belanger, 63, a stationary engineer at Crown Hotel, Providence, R. I. died in that city on April 22.

Samuel A Fraser, 62, stationary engineer for Brownville Paper Co, Watertown, N. Y. died April 24 after a lingering illness.



Built to your Specifications

The VHT and VHTA Vertical Boiler-Feed Pumps A Must where high pressure and low capacities are needed

The VHT and VHTA units were developed to meet the demand for centrifugal pumps to efficiently handle low capacity, high pressure, pumping jobs.

They have proven themselves to be reliable, sturdy, and well designed pumps.

Internal bearings carry radial loads only; any thrust load developed is carried by the driver. The internal bearings are constantly lubricated by the liquid being pumped. The single stuffing box may be arranged for bleed-off, cold-oil circulation through the packing, or solid packed as the service may require.

Both the VHT and VHTA are multi-stage vertical units with opposed impellers. The pumping elements are made up of sections and as many may be used as necessary to produce the desired head.

Where high pressure, high efficiency and low capacity are desired and where floor space is at a premium, THIS is the pump for the job.

Ask an I-R engineer for further details.

CAMERON PUMP DIVISION

AIR TOOLS • ROCK DRILLS
COMPRESSORS • TURBO BLOWERS
CENTRIFUGAL PUMPS • CONDENSERS
OIL AND GAS ENGINES

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y.

68-10

in expansion joints

there is only one BADGER

• E. B. Badger & Sons Co. is the original and sole manufacturer of BADGER Expansion Joints

BADGER Self-equalizing Corrugated Expansion Joints should be a "must" on all pipe-line installations.

Because only in *Badger* Expansion Joints are the flexing movement and stresses definitely directed so that:

All points of the surface of each corrugation share its individual load equally, and

All the corrugations share the stress load equally.

With Badger ALL-CURVE Directed Flexing Rings and Badger ALL-CURVE corrugations, excessive stresses can't localize in pockets, corners or junctions, nor pile up unevenly among the corrugations. They can't endanger the line or shorten the life of these superbly engineered joints.

Special Badger methods of forming the corrugations from a single piece of tubing contribute further to the strength of these joints, and a special Badger heat treatment preserves their flexing qualities.

Each corrugation affords a definite standard of traverse, according to its depth and the diameter of the joint. This makes it easy to determine the number of corrugations required to absorb the maximum expansion of any length of line.

When you install dependable, long-lasting Badger Self-equalizing Corrugated Expansion Joints, your pipe-expansion problems are solved.

MADE IN COPPER, STAINLESS STEEL AND OTHER ALLOYS — Copper for normal pressures and temperatures; Stainless Steel and other alloys for higher requirements—and where corrosion is a prob'em. Single or multiple corrugations—for traverses from a fraction of an inch upward. Also made in Non-equalizing type (without rings) for uses that do not require added protection. Send for Bulletin No. 100 (*Self-equalizing*) or No. 200 (*Non-equalizing*).

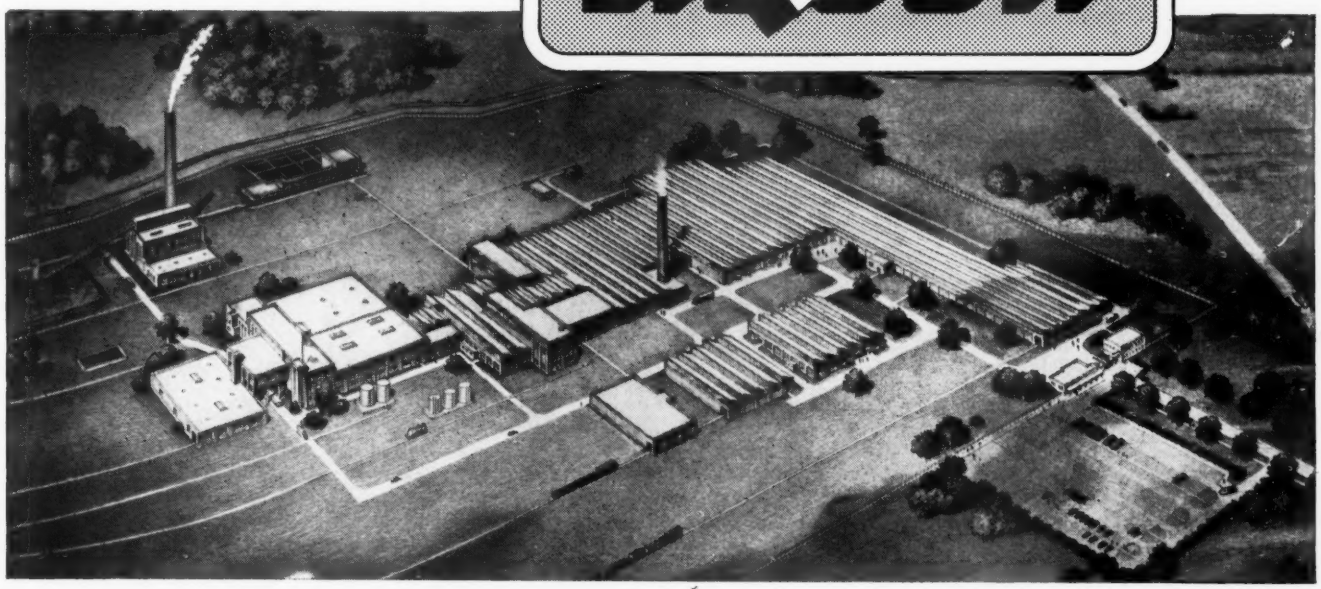
Badger

E. B. BADGER & SONS CO., Cambridge Division, 260 Bent Street, Cambridge 41, Mass.
Agents In Principal Cities

PACKLESS CORRUGATED EXPANSION JOINTS

AT AMERICAN ENKA... Water Treatment Problems

Solved by LIQUON



This is one of many instances where critical consulting engineers have come to LIQUON for Water Softening Equipment because of the helpful service offered by the LIQUON engineers and chemists, the modern and efficient design of LIQUON equipment, and the prompt shipments provided by LIQUON facilities.

THE REQUIREMENTS

The Lowland, Tennessee, plant of American Enka Company uses raw river water with 68 ppm calcium and magnesium hardness, 36 ppm bicarbonate alkalinity, 10 ppm silica, and 18 ppm free CO_2. They require a present boiler feed capacity of 510,000 gpd, and 2,560,000 gpd of process water. Various problems of available water-treating materials, permissible pressure losses, and restrictions in operating costs complicated the selection of processes and equipment.

THE LIQUON EQUIPMENT

The LIQUON equipment selected by The H. K. Ferguson Company, Consulting Engineers for the boiler feed supply, includes a two-stage hot process softener with chemical feeds, and three Anthrafilt Filters. For process water, a sodium zeolite plant with 6 rubber-lined shells and automatic valves was chosen. All equipment was delivered *on time.*

•

Whatever may be *your* water treatment problems, look to LIQUON for their solution. LIQUON recommendations are backed by more than 30 years of pioneering experience in liquid conditioning of every kind—and you can be sure of prompt, efficient service from the skilled, conveniently located LIQUON field engineering representatives.

LIQUID CONDITIONING CORPORATION

114 EAST PRICE STREET, LINDEN, N. J.

Engineering Service Representatives in Principal Cities

Send the Coupon LC-164

LIQUID CONDITIONING CORPORATION
114 East Price St., Linden, N. J.

Please send me copy of your Condensed Catalog on Water Treatment Processes and Equipment.

NAME_____

POSITION_____

COMPANY_____

ADDRESS_____ P-8-48

IT'S TAPER-LOCK! IT'S REVOLUTIONARY!

The simplest, surest mechanism ever devised for holding wheels to shafts. Another Dodge "first" —and the biggest development in this field in years!

The TAPER-LOCK Sheave breaks all speed records in mounting. Slip it on, line it up and tighten while sighting! Saves time—saves money.

Easy on, easy off! Disengages with less effort; holds fast to the shaft with firmness equivalent to a shrunk-on fit.

No flange. No collar. No protruding parts. Close mountings are possible. Bushing extends entire length of hub. TAPER-LOCK runs *true*.

A complete unit—in a complete range of sizes in Dual Duty (A and B); B, C, and D grooves. Write us for detailed bulletin, A175C, on this new and different taper bore sheave.

DODGE MANUFACTURING CORPORATION
Mishawaka, Indiana

DODGE
of Mishawaka, Ind.

CALL THE TRANSMISSIONEER

He is your local Dodge Distributor—factory trained—qualified to suggest ways to improve your machine performance, increase production. Look for his name under "Power Transmission Equipment" in your classified phone book.

TAPER-LOCK: Trade Mark Registered U. S. Pat. Off.

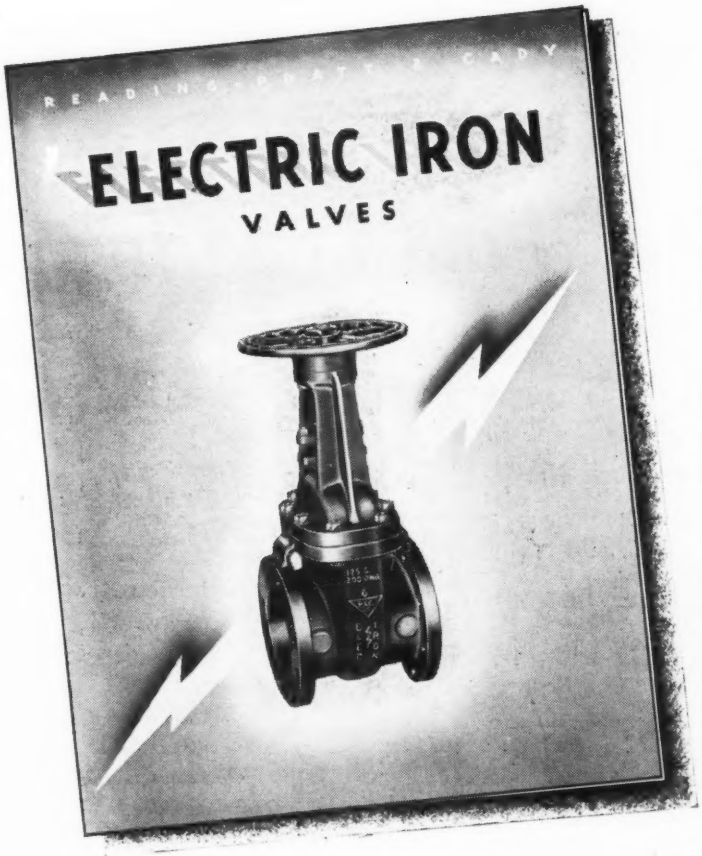
Copyright, 1948, Dodge Mfg. Corp.

NAME PLATES

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, ETCHING COMPANY OF AMERICA, 1520 MONTANA STREET, CHICAGO 14, ILLINOIS

BETTER IRON MAKES BETTER VALVES AT READING-PRATT & CADY

There is one *BEST* method of melting and refining iron for valve castings. It is R-P&C's *Electric Furnace method.*

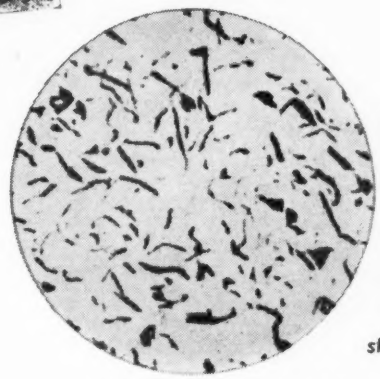


THIS FOLDER tells you why Electric Iron is better than iron made by the conventional cupola process. Interesting information if you buy or specify iron valves. Write for DH-18.

YOU PAY NO PREMIUM for the extra quality in R-P&C Electric Iron Valves. But you do get better valves — longer lasting, more dependable.

Electric Furnace Cast Iron is a low-sulphur, low-phosphorus iron of homogeneous, fine-grained structure. It is clean and of uniform quality.

Before buying or specifying iron valves, get the complete story of R-P&C Electric Furnace Iron. Write for our descriptive folder—DH-18.



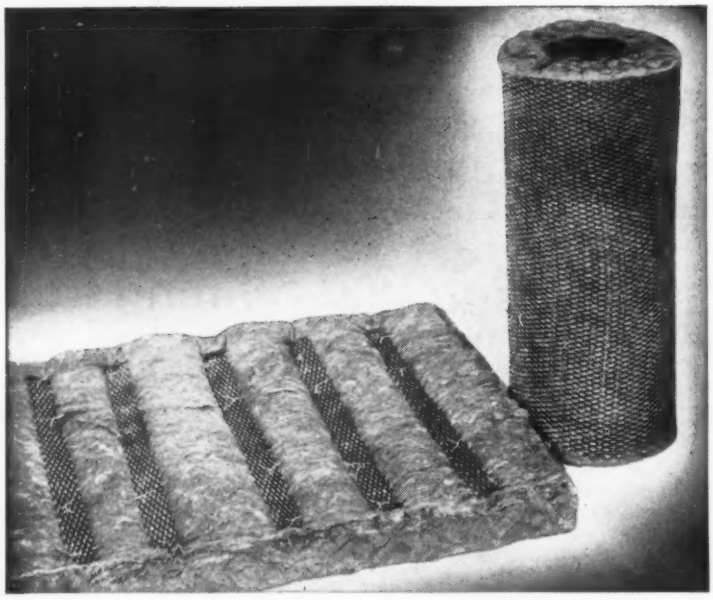
UNIFORM STRUCTURE
Photomicrograph (enlarged 100 times) shows even distribution of fine graphite flakes. This contributes to the uniform structure of R-P&C Electric Iron.

ACCO

Reading, Pa. • Atlanta • Baltimore • Boston • Chicago • Denver • Detroit • Houston
New York • Philadelphia • Pittsburgh • San Francisco • Bridgeport, Conn.

READING-PRATT & CADY DIVISION
AMERICAN CHAIN & CABLE

READING-PRATT & CADY VALVES



More power
to you with
EAGLE-PICHER
Insulations

Eagle-Picher "77" Pipe Covering

is permanently efficient to 1200 F!

Because it remains efficient, even at the high temperature of 1200 F, Eagle-Picher "77" Pipe Covering is widely preferred by industry for permanent protection against heat loss through pipes. It consists of chemically and physically stable Eagle-Picher Insulating Wool felted and secured between metal fabrics. Does an outstanding job on steam piping and other types of hot lines. Can be cut on the job with ordinary metal shears. Water and steam repellent. Complete data sent on request.

The complete line of Eagle-Picher Insulations includes:

Eagle-Picher Super "66" Cement
Eagle-Picher Supertemp Block
Eagle-Picher Blankets
Eagle-Picher
Low Temperature Felts
Eagle-Picher Loose Wool
Eagle-Picher Stalastic
Eagle-Picher Insulseal
Eagle-Picher Insulstic
Eagle-Picher Swetchek
Eagle-Picher Finishing Cements

EAGLE-PICHER INSULATIONS for

EAGLE EP PICHER

High and low temperature

Since 1843
THE EAGLE-PICHER COMPANY
CINCINNATI (1), OHIO

What's your need in SIZE?

Globe seamless steel tubing is made hot finished and cold drawn in alloy and carbon steels in sizes from ½ inch to 6⅝ inches outside diameter.

Globe seamless stainless steel tubing is available in tube sizes from ½ inch to 6⅝ inches outside diameter and in pipe sizes ⅛ inch to 6 inches, standard, extra strong and double extra strong weights.

Gloweld (electric welded) stainless steel tubing may be had in sizes ranging from ¼ inch to 5 inches outside diameter inclusive, in standard weight pipe (schedule 40) sizes ⅛ inch to 2 inches, and in light weld pipe (schedule 10) size ⅛ inch to 4½ inch, inclusive.

Your tubing needs may lie somewhere within the above ranges — whatever your requirements, Globe is qualified by experience and facilities to supply you with tubing of the quality and uniformity you demand. GLOBE STEEL TUBES Co., Milwaukee 4, Wisconsin.

GLOBE
Stainless
STEEL TUBES

THE ONE-MAN PLANT

The small plant picture has changed... Higher fuel and labor costs are chiefly responsible.

Today's small plant must be more efficient and require less operating labor. It should be a one-man plant. To effect maximum economy it should be conservatively designed to use a wide range of coal characteristics. Overall design should include complete mechanization with respect to coal and ash handling, and firing, plus a reasonable amount of instrumentation and controls. Interior and exterior cleanliness and low maintenance should characterize its operation.

To secure proper coordination and integration of all elements there should be *single responsibility* in the design and construction of this modern plant. These design features require the same high calibre of engineering as the large plant.

Few such plants are in existence today . . . there should be thousands. The time is now for progressive consulting engineers and combustion equipment manufacturers to combine efforts in modernizing small plant design. Consumers, too, should recognize that the additional investment required will pay out quickly and return large dividends.

The figures in the table below, which are typical for most areas, show the relationship of various methods of firing and that maximum economy is achieved by the fully mechanized coal-fired plant.

COSTS OF 150-HORSEPOWER PLANTS (100 psi)*

	Hand-Fired	Hopper Stoker	Hopper Stoker With Conveyor	Oil
Investment (Equipment)	$12,400	$14,630	$18,980	$14,230
Operating Costs, per year				
Fuel	11,600	9,800	9,800	16,320
Other Operation	8,530	5,340	4,440	2,880
Total Operating Costs	$20,130	$15,140	$14,240	$19,200
Saving Over Oil Firing	-0-	$ 4,060	$ 4,960	-0-

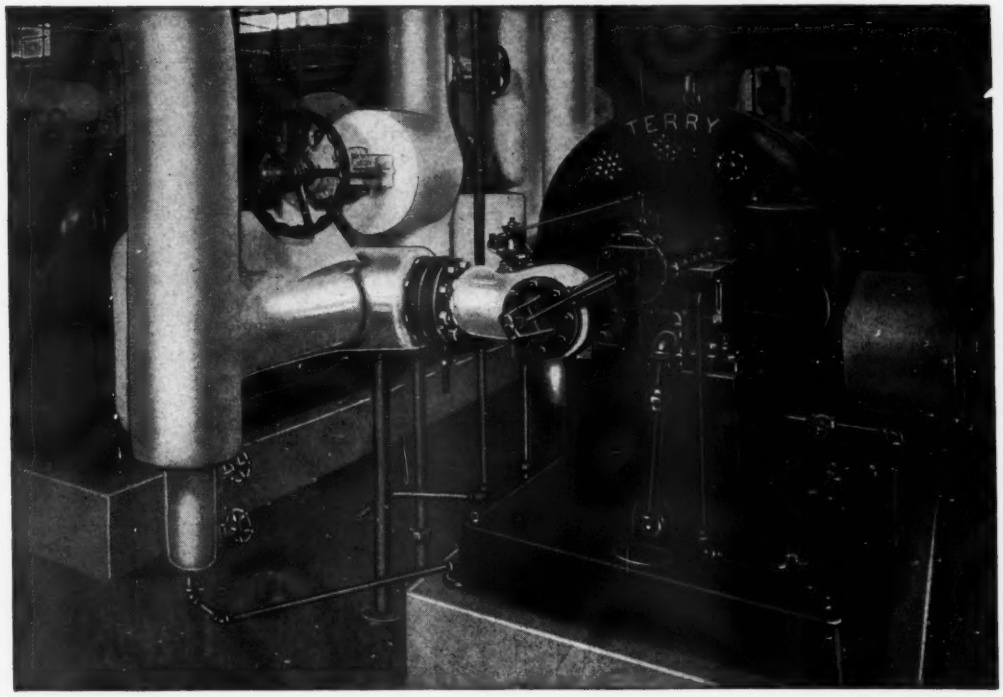
As a Service to Industry and in the interests of better fuel utilization the Fairmont Coal Bureau is collaborating with consumers, consulting engineers and equipment manufacturers in the design of small fully mechanized plants. If interested please write:

FAIRMONT COAL BUREAU

122 EAST 42nd STREET NEW YORK 17, N. Y.

*From "Modern Methods for Mechanical Handling of Coal and Ash in the Small Boiler Plant," by Bituminous Coal Research, Inc.

TERRY



GENEROUS BLADE CLEARANCES IN THIS 900° TERRY WHEEL TURBINE INCREASE DEPENDABILITY . . . .

The 290 H. P. Terry Turbine shown above is used for Boiler Feed Pump Drive in a recently completed central station. It operates with steam at 850 lbs.-900° F. and employs a Terry one piece wheel, as illustrated at the left.

The blades of this Turbine have large radial and axial clearances. They are further protected by projecting rims at the sides of the wheel. These rims would take without damage any rubbing that might occur if the radial clearance became reduced. It is therefore impossible for the blades to foul.

The side clearance is very large - one inch - so that end play can do no damage.

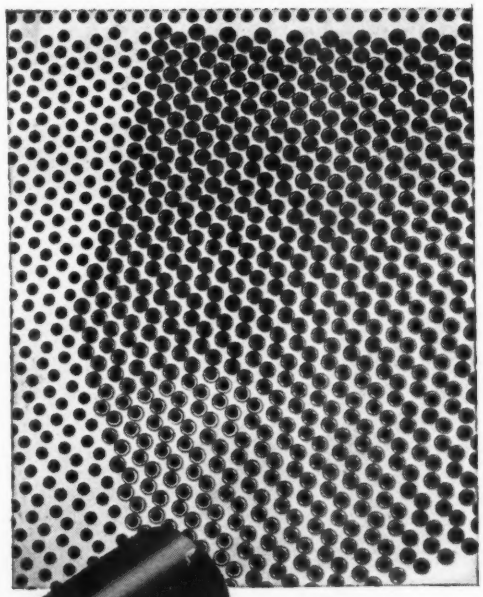
Such construction makes for dependable operation.
- Descriptive bulletins sent on request. Ask for S-116.

T-1167

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.

SAVE COSTS!

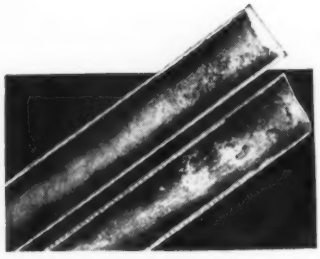
SAVE YOUR CONDENSER TUBES



WITH

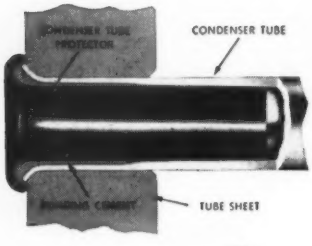
Section of tube sheet with JOHN CRANE Condenser Tube Protectors installed. Entrance sections are streamlined, for maximum hydraulic efficiency.

JOHN CRANE CONDENSER TUBE PROTECTORS



RESTORE OLD TUBES

to full dependability—covers eroded inlet area—prolongs life.



PROTECT NEW TUBES

Safeguard tubes from erosion, abrasion, and other destructive factors at the beginning—*before trouble starts.*

SEND FOR THIS BULLETIN

Power and Marine Engineers are invited to call experienced Crane Engineers in cities named below for prompt assistance.

- **JOHN CRANE Condenser Tube Protectors are an invincible armor for the inlet ends of condenser tubes. Highly resistant to all damaging action.**
- **Molded of hard tough thermo-setting plastic—not affected by most chemical and volatile liquids.**
- **Easy and inexpensive to install. Save tube costs over and over.**
- **Unaffected by temperatures to 275°F.**
- **Provides a Venturi entrance. Reduces turbulence.**

CRANE PACKING COMPANY 1830 CUYLER AVE. • CHICAGO 13, ILL.

BALTIMORE, BOSTON, BUFFALO, CLEVELAND, DALLAS, DETROIT, HOUSTON, LOS ANGELES, NEW ORLEANS, NEW YORK, PHILADELPHIA, PITTSBURGH, SAN FRANCISCO, ST. LOUIS, TULSA

CRANE PACKING CO., LTD., Hamilton, Ontario, Canada. Branches: Montreal, Toronto, Vancouver

I DO TWO JOBS

BETTER THAN ANYONE ELSE

"I am De Laval Centrifugal Force. I purify lubricating oil, and because I can do two jobs at once I offer more complete protection for plant operating men.

"The two jobs I do? Well, I

1 — Remove dirt and sludge

2 — Remove water continuously

"I never do an incomplete job of maintaining oil (for in purifying oil, dirt removal is only ***part*** of the job). As often as not, water is the real trouble-maker. Condensate in turbine oil, for example, leads directly to the formation of sludge. Whatever the impurity in the oil, I promptly remove it.

"I am also a good Oil Purifier because I do not remove oil-soluble additives. Oil is discharged with such additives intact.

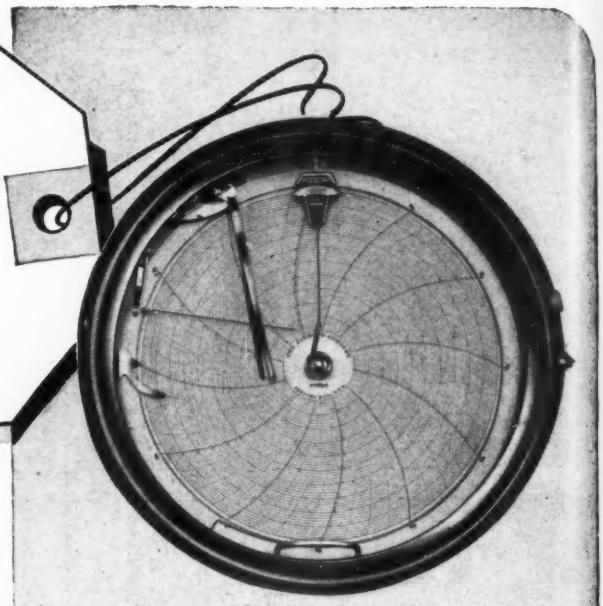
• "Read about me in Bulletin 400."

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

DE LAVAL

Lubricating Oil Purifiers

Automatic Cure for Plugging of Travelling Intake Screens



Simple FOXBORO Control System operates screen whenever suction level drops . . .

HERE'S AN EASY, inexpensive way to make sure that your condenser well won't go dry if excessive refuse causes sudden plugging of the travelling screen.

Foxboro Travelling Screen Control supplements periodic screen-timing with a "judgment" that's almost human. By continuous measurement of water level on each side of the screen, this sensitive control system independently starts the cleaning action whenever a predetermined safe differential is exceeded. When correct levels are again restored, it automatically shuts down screen and spray motors. In case of unusually severe fouling of the screen, the controller can also operate a warning signal.

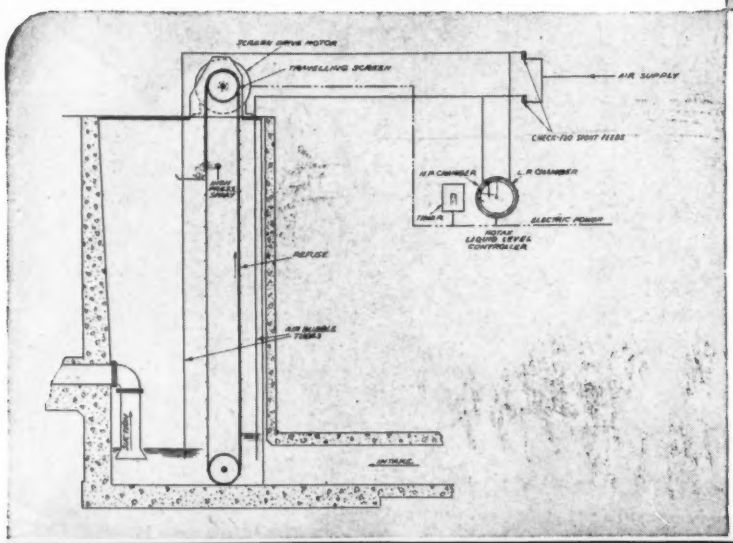
Write for complete information on Foxboro Travelling Screen Control and Bulletin 184-4 containing details of Foxboro Rotax Controllers. **The Foxboro Company, 68 Neponset Ave., Foxboro, Mass., U. S. A.**

ROTAX

Liquid Level Controller

The "heart" of Foxboro Travelling Screen Control. An extremely simple, positive-operating controller that translates level differential into operation of motors. In addition, it can operate a warning horn or light in case of unusually severe plugging.

Exclusive Rotax features include: positive electrical contact; special lock-up circuit which eliminates chattering of control relays; constant brush pressures; self-cleaning platinum contact surfaces; easy setting of control point; and freedom from maintenance.



SCHEMATIC DIAGRAM, left, shows simplicity of Foxboro Travelling Screen Control System. Water level differential through the screen is continuously measured by bubble tubes. The Foxboro Rotax (electric) Controller starts and stops the screen and spray motors, as required to maintain safe differential.

FOXBORO
REG. U. S. PAT. OFF.

RECORDING · CONTROLLING · INDICATING
INSTRUMENTS

TO COMBAT HIGH PRESSURE SUPERHEATED STEAM OR HOT GASES

specify... ANKORITE #804

THE ANCHOR PACKING CO.

STAYS SOFT AND RESILIENT IN SPITE OF HEAT

"Ankorite" # 804 is the ideal packing to use against high pressure, superheated steam or for hot and dry gases.

Its construction is something special: Pure asbestos, graphite plastic core having an outer jacket of closely braided high quality asbestos yarn reinforced with Monel metal wire. It will *stay soft* against high pressure and high temperature.

"Ankorite" # 804 is furnished in spirals, coils and ring form—packing sizes ¼" up to 1¼". Also in sets of die-formed conical shaped rings, where specifications permit.

ITS USES: VALVE STEMS...THROTTLE VALVES...CONTROL VALVES...EXPANSION JOINTS . . . FURNACE DOORS . . . AUTO CLAVES . . . AND MANY OTHER USES!

Write today for full details.

THE ANCHOR PACKING COMPANY

GENERAL OFFICES: PHILADELPHIA, PA.

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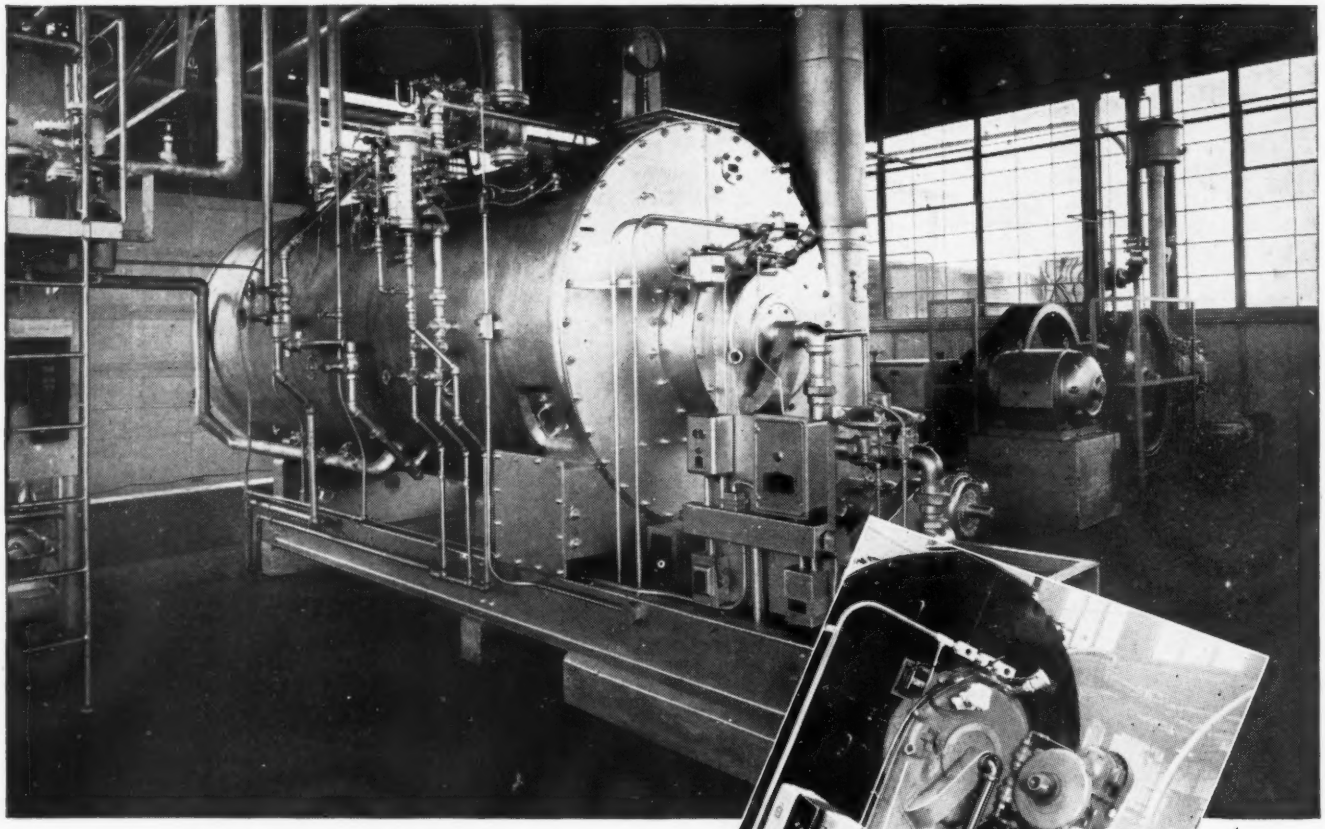
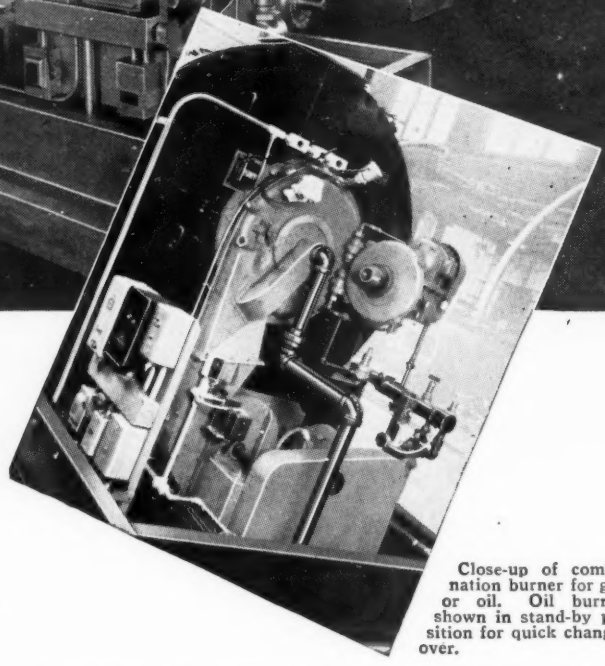
St. Louis, Missouri

A STEAM GENERATOR WITH UNUSUAL ADAPTABILITY AND FLEXIBILITY—BURNS GAS OR OIL WITH EQUAL EFFICIENCY



200 HP. Cleaver-Brooks Steam Generator equipped with gas-burner.



Close-up of combination burner for gas or oil. Oil burner shown in stand-by position for quick change-over.

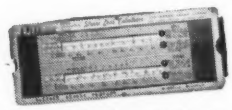
Get Guaranteed 80% Efficiency with either Fuel with a Cleaver-Brooks Steam Generator

INSTALL a steam generator equipped to burn the available fuel in your area—either oil or gas. Cleaver-Brooks offers all three: (1) Oil-fired models, (2) gas-fired models, and (3) models equipped with a combination burner which permits alternate use of gas or oil, providing for a quick change-over from one fuel to the other. Equally important—you get Cleaver-Brooks' guarantee of at least 80% efficiency from full load down to 30% of rating—with either gas or oil as fuel.

And that's not all—more advantages are gained using a Cleaver-Brooks "packaged" steam generator. They give you clean, smokeless operation—eliminate fuel-ash handling—require no high or costly stacks—no special foundations—fit under low headroom—flexible operation to meet fluctuating loads. Fully meet all codes.

Investigate Cleaver-Brooks Steam Generators—there's a size to fit your needs—15 to 200 p.s.i., 15 to 500 HP.

CLEAVER-BROOKS COMPANY
332 E. KEEFE AVENUE • MILWAUKEE 12, WISCONSIN



WRITE on your business letterhead for free Steam Cost-Calculator — a ready-reference slide rule showing comparative steam cost when using oil, gas or coal as fuel.

Cleaver-Brooks

"Packaged" STEAM GENERATORS

HAVE SERVED INDUSTRY FOR MORE THAN FIFTEEN YEARS

CONDENSED DETAILS

4 units capacity each approximately 15,000 lbs. per hr. at 160 lb. pressure. Gas and oil fired with complete automatic combustion control.

Other Construction Now in Progress:

1. Complete power plant piping, El Centro Steam Plant.
2. Design and construction wind tunnel job, California Technical Institute.
3. Erection of three 825,000 lb. per hr. steam generator, Bureau of Power and Light, Los Angeles.
4. Design and construction Compressor Station, City of Long Beach, Calif.

This Modern Plant

Built by Specialists

is a fine example of engineering correctly applied to steam generation

As specialists in the design and construction of steam plants, compressor plants and process piping, the OFCCO organization offers a service based on competence and experience in meeting the needs of power users.

Ofcco
CONSTRUCTION CO., INC.

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LONG BEACH 6, CALIFORNIA

Engineers ... Contractors ... Designers

Representatives of Union Iron Works Boilers

ASME Authorized Pressure Piping Erectors and Boiler Assemblers

A Cottrell Precipitator Installed by Research Corporation

WILL COLLECT OVER

95%

OF YOUR FLY ASH

A Research Corporation Cottrell will effectively clean stack gases by removing over 95% of all the different size fly ash particles suspended in the gas.

It will operate with a low draft loss, averaging only a few tenths of an inch of water across the Cottrell. The electrical power required for energizing the Cottrell is extremely low, amounting to only .5 to 1.0 KWH per 100,000 cubic feet of gas cleaned.

The *plus* efficiency of Research-installed Cottrells is assured by Research's experience gained in over 35 years and 1100 installations. This knowledge is essential to successful dust control, for every application presents its own peculiar problems. Each installation must be individually engineered.

Research-Cottrells can be installed to furnish any degree of efficiency desired, and to handle any volume of boiler gas. Full information is presented in an interesting 28-page bulletin. Write for your copy today.

Research Corporation Installations

47 CARBON BLACK PLANTS
200 METALLURGICAL INSTALLATIONS
203 ACID PLANTS • 34 PAPER MILLS
262 DETARRING INSTALLATIONS
195 POWER STATIONS
71 STEEL PLANTS • 95 OIL REFINERIES
AND MISCELLANEOUS INSTALLATIONS

RESEARCH CORPORATION

405 Lexington Avenue, New York 17, N. Y.
122 South Michigan Avenue, Chicago 3, Illinois

whatever your piping needs

Benjamin F. Shaw Company is qualified to pre-fabricate and erect piping —throughout the world.

President

BENJAMIN F. SHAW COMPANY
2ND & LOMBARD STS. • WILMINGTON 99, DELAWARE

KNOWN SINCE 1893 FOR HIGH-QUALITY PIPING PRE-FABRICATION AND INSTALLATION

R/M No. 1840A

R/M plastic packings

Out of R/M laboratories has come a series of plastic packings that have proved particularly satisfactory in meeting special operating conditions.

R/M No. 1840A, shown above, is typical of these packings and is recommended for rods, valve stems, centrifugal pump shafts, and similar applications where temperature does not exceed 600° F. A related type is R/M No. 1840B, which contains a non-frictional metal.

Where packing is exposed to gasoline, fuel oil and other petroleum products, a third R/M plastic packing, No. 1840C, is widely used.

These specialized plastic packings are typical of the R/M Packings available to you through your authorized R/M distributor. For every special packing problem, and for your day-to-day packing needs, call your R/M distributor.

RAYBESTOS-MANHATTAN, INC.

ASBESTOS TEXTILE & PACKING DIVISION

Manheim, Pa. • Bridgeport, Conn. • North Charleston, S. C. • Passaic, N. J.

We also manufacture a complete line of Asbestos Textiles, Friction Materials, and Industrial Rubber Products.

Test Control
IS IMPORTANT
In Your Own Boiler Plant

A part of Dearborn engineering service is the recommendation of the correctly worked out test control procedure for your particular plant. Test control is the most important factor in boiler water conditioning and is the only means for adjustment and treatment. Blowdown and operating difficulties are avoided if the correct chemical balances are maintained at all times. This is the function of control testing.

The Dearborn Service Engineer is prepared to discuss this phase of water treatment with you. Call him or write to us direct, and we will see that he gets in touch with you.

The Dearborn Engineer works with plant personnel. Carries his own equipment or uses yours for on-the-spot tests.

Dearborn
TRADE MARK REGISTERED

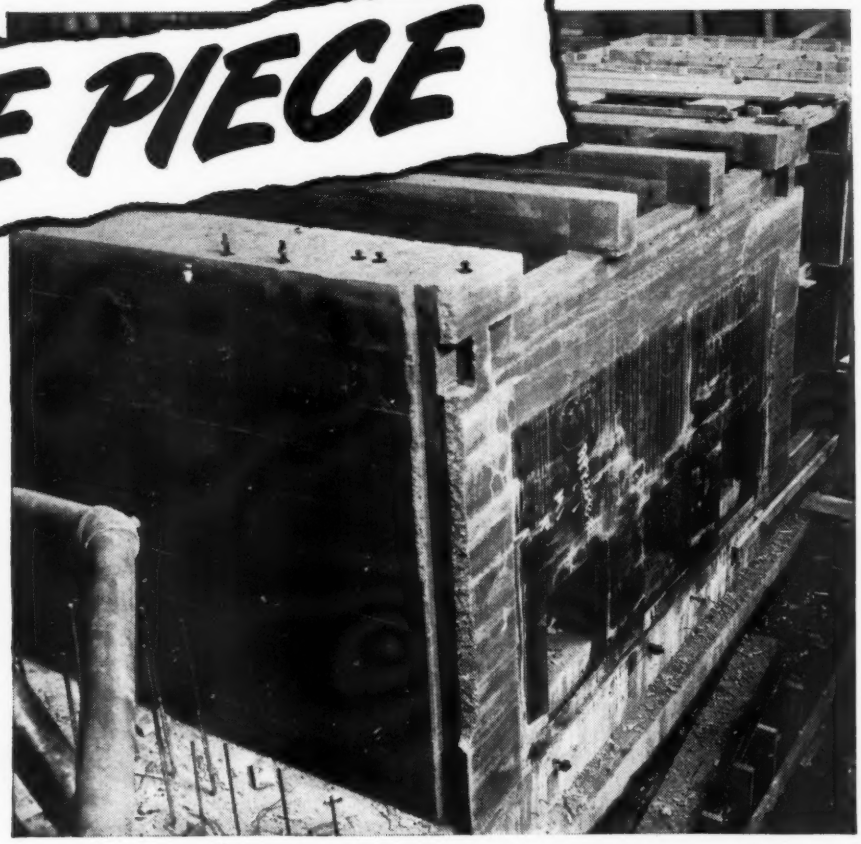
THE *Leader* FOR OVER 60 YEARS

ENGINEERING SERVICE AND WATER TREATMENT

DEARBORN CHEMICAL COMPANY
310 S. Michigan Ave., Chicago 4 807-15 Mateo St., Los Angeles
205 E. 42nd St., New York 2454 Dundas St., West, Toronto

Boiler foundation . . . and Ash pit . . .

in ONE PIECE



LUMNITE concrete simplifies construction of heat-resistant foundation with self-lined ash pit

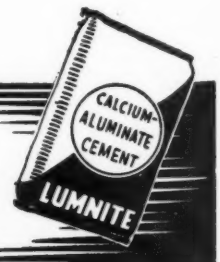
Built with heat-resistant LUMNITE concrete, this foundation supports boiler settings and stokers and eliminates need for separate lining in ash pits. The LUMNITE concrete withstands heat, corrosion and wear from ashes and cinders.

Monolithic, one-piece construction provides smooth surfaces without joints to wear ragged and tear out. The LUMNITE concrete, made with an aggregate of crushed firebrick, needs no refractory lining. The concrete remains sound and strong under continuous soaking heat from the boiler—it is good for temperatures well above 2000° F.

Fast construction, too, results from using LUMNITE—the rapid-hardening cement. Full load can be set on the foundation 24 hours after the concrete is placed.

Here's the best *and quickest* concrete for your boiler foundations, ash pits and many other power-plant jobs. Let us tell you how to use LUMNITE for flue and stack linings, coal-bunker linings, cinder catchers, overnight maintenance. Write us for booklets and ask us about using LUMNITE concrete on your particular job.

For further information, write to:



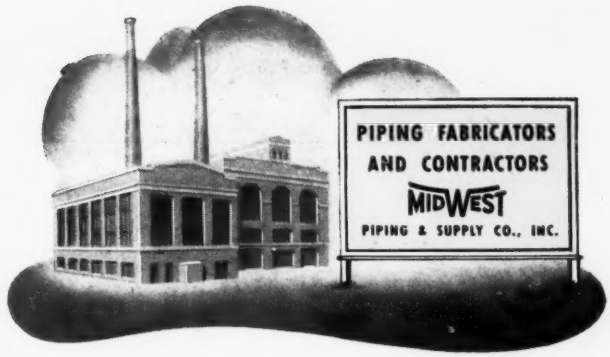
Lumnite Division

UNIVERSAL ATLAS CEMENT COMPANY

UNITED STATES STEEL CORPORATION SUBSIDIARY

135 EAST 42nd STREET • NEW YORK 17, N. Y.

"THE THEATRE GUILD ON THE AIR"—*Sponsored by U. S. Steel Subsidiaries—Sunday Evenings—September to June—ABC Network*



FIRST-HAND EXPERIENCE IN THE FIELD

Helps Maintain the HIGH QUALITY of

MIDWEST

PRE-FABRICATED PIPING

Midwest not only has a pipe fabricating organization of exceptional skill . . . it also has a Construction Department which has been erecting all kinds of piping for 48 years.

As a result, our shops get continuous first-hand field reports on the erection of fabricated piping. Our Construction Department constantly keeps us mindful of the importance of accurate alignment, thorough cleaning, careful inspection and testing of all bends, welded subassemblies, etc., before they leave the shops.

This situation has been of immense value in maintaining the high quality of Midwest Piping. The Construction Department also is the source of countless suggestions for improvement in pressure piping. All Midwest customers benefit from the accumulation of these suggestions.

Midwest, with four fabricating plants strategically located, has nationwide experience in satisfying the piping needs of all industries. You will always find it advantageous to use Midwest Pre-Fabricated Piping . . . either when purchased on the basis of materials only or piping completely installed.

MIDWEST PIPING & SUPPLY CO., INC.
MAIN OFFICE: 1450 SOUTH SECOND ST., ST. LOUIS 4, MO.

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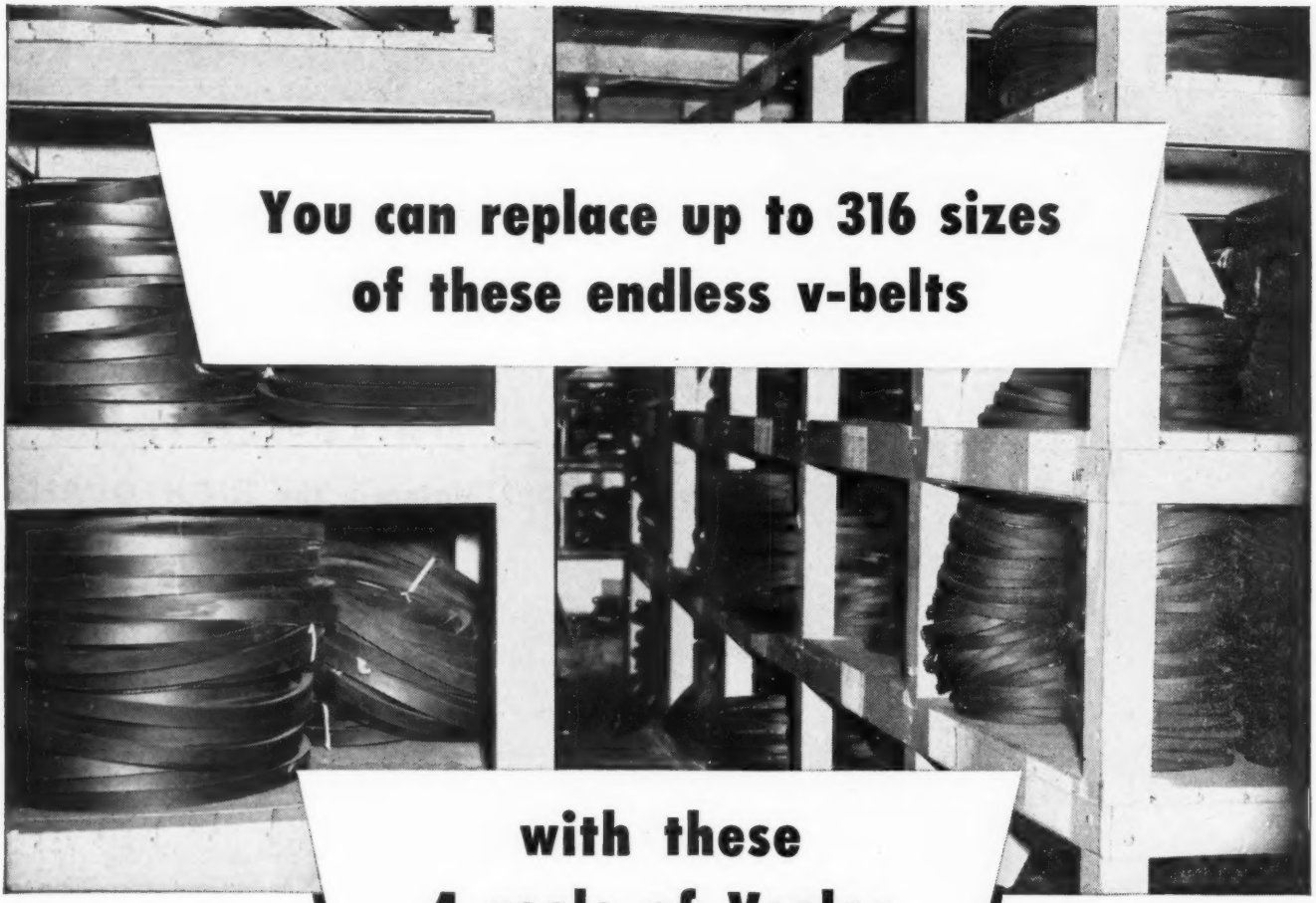
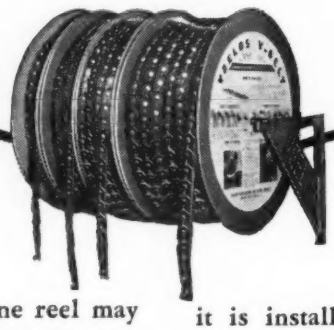
PIPING FABRICATORS AND CONTRACTORS

3480



You can replace up to 316 sizes of these endless v-belts

with these 4 reels of Veelos



Just four reels of Veelos in your stockroom give you replacements for as many as 316 sizes of endless V-belts. Very likely you require less. One reel may give you a complete V-belt inventory. With Veelos, the link V-belt, any length belt is quickly uncoupled, made endless and installed. Belt replacements for any type drive are always immediately available. Standard reels hold 100 feet, save storage space.

Ease of installing Veelos provides substantial savings in installation time. On drives with fixed centers, it is installed without moving the motor or dismantling the machine.

Veelos is available in all standard sizes . . . fits all standard grooves. Sales engineers in principal cities; 350 Veelos distributors throughout the country.

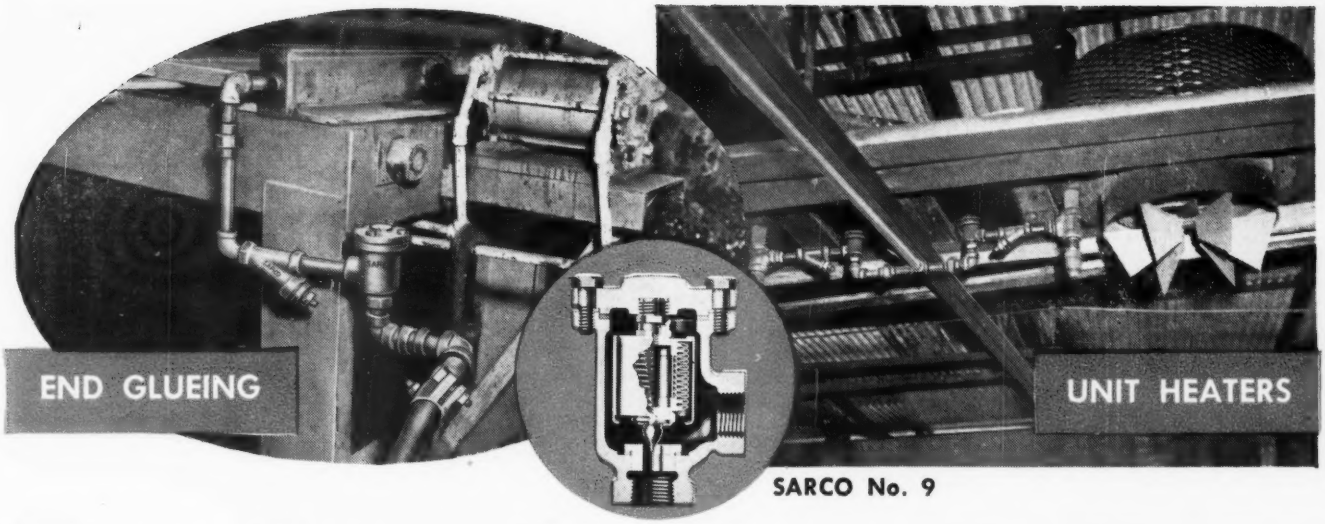
VEELOS
THE LINK
V-BELT

NEW CATALOG gives you all the facts about the important advantages of Veelos and supplies complete engineering data. Fully illustrated, it shows Veelos at work in industry after industry. Your copy sent on request.

MANHEIM MANUFACTURING & BELTING COMPANY
MANHEIM, PENNSYLVANIA

VEELOS is known as VEELINK outside of the United States

ADJUSTABLE TO ANY LENGTH • ADAPTABLE TO ANY DRIVE



SARCO No. 9

Drying, Glueing AND *Heating*

COST LESS THE SARCO WAY

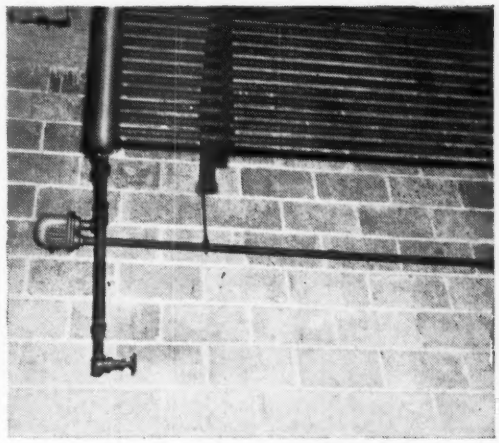
In any industry where a lot of heat is used, there is one sure way to keep manufacturing costs down, particularly if you are in a business where quality as well as quantity counts.

Lincoln Industries of Damascus, Va., manufacturers of quality furniture, is a typical example.From the initial dry kilns to end glueing, veneer dryers and the finishing rooms, lots of heat and reliable heat are the two essentials for efficient operation of this busy conveyor line plant.

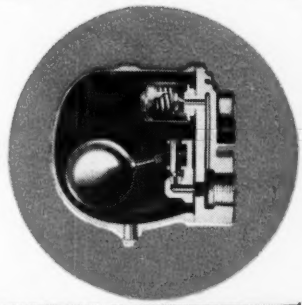
At every spot where condensate could back up and slow down production or cause rejects, a Sarco Steam Trap has been installed. At every point where a Sarco trap can utilize more of the heat before the condensate is released, the well known Sarco No. 9 Thermostatic Trap is used.

At the cost of a few rejects, production has actually been speeded up and because the steam is used more efficiently, the cost of fuel has gone down.

Ask the Sarco Representative near you to look over your plant.

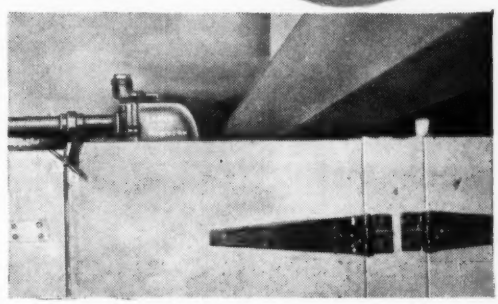


KILNS



FLOAT-THERMOSTATIC TRAP

DRYING



168

SARCO SAVES STEAM

SARCO COMPANY, INC.

Represented in Principal Cities

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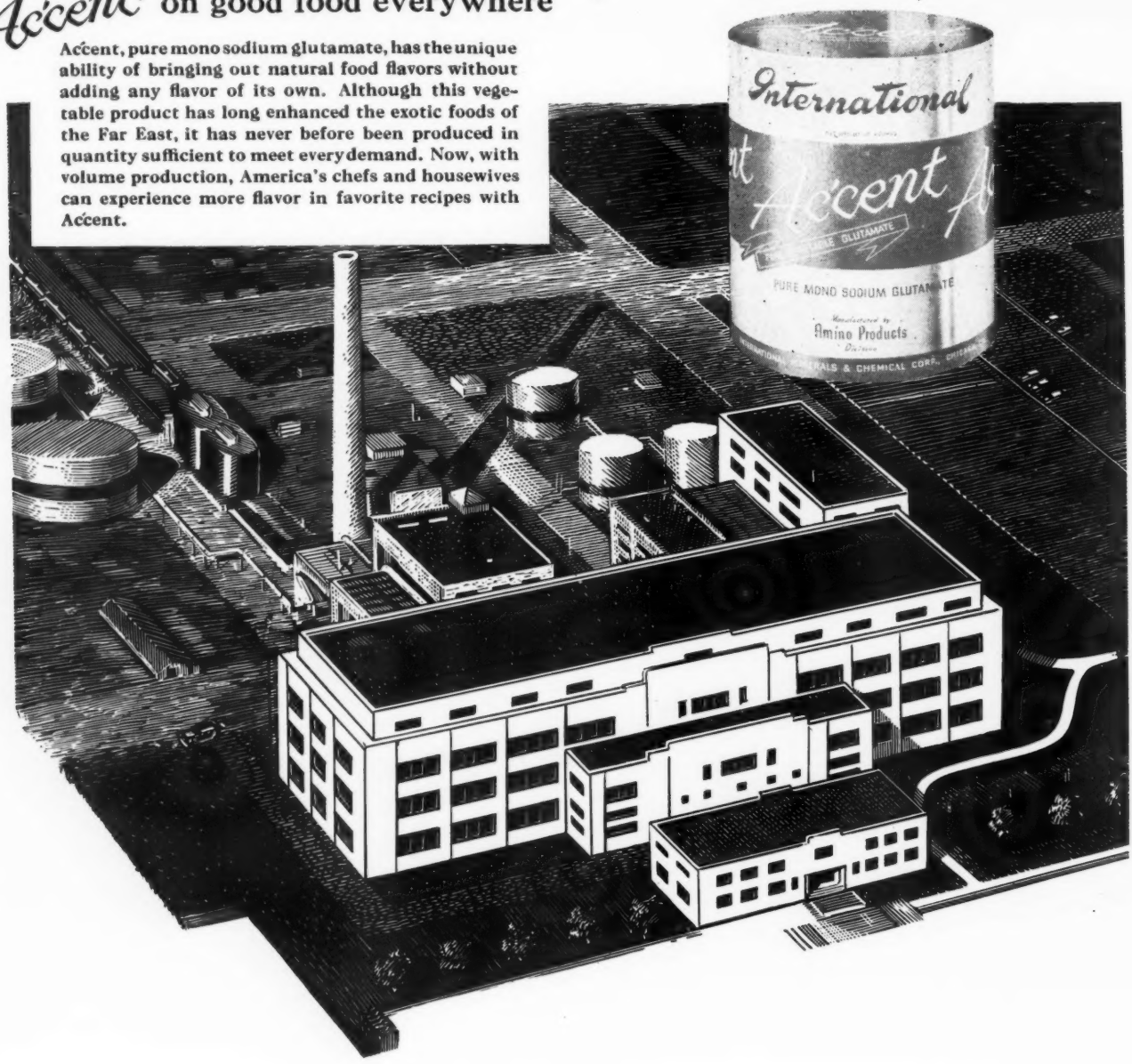
Accent® on good food everywhere

Accent, pure mono sodium glutamate, has the unique ability of bringing out natural food flavors without adding any flavor of its own. Although this vegetable product has long enhanced the exotic foods of the Far East, it has never before been produced in quantity sufficient to meet every demand. Now, with volume production, America's chefs and housewives can experience more flavor in favorite recipes with Accent.



ACCENT ON ENGINEERING

This food processing plant at San Jose, California, having the largest production capacity in the mono sodium glutamate industry, was designed and constructed by Stone & Webster Engineering Corporation for International Minerals & Chemical Corporation.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER, INC.

POWER

Rely on EXIDE BATTERIES for dependable Diesel cranking

Exide Batteries in Diesel-powered equipment assure dependable cranking performance . . . in all weather . . . in all climates. They're built specifically to do even the toughest cranking jobs . . . with extra power and efficiency . . . day after day . . . year after year.

Exide Batteries are cranking Diesel engines on trucks, buses, off-the-highway equipment, ships, railroad locomotives, in power plants and many other applications. For dependable performance, long life and ease of maintenance, specify Exide Batteries.

Exide BATTERIES

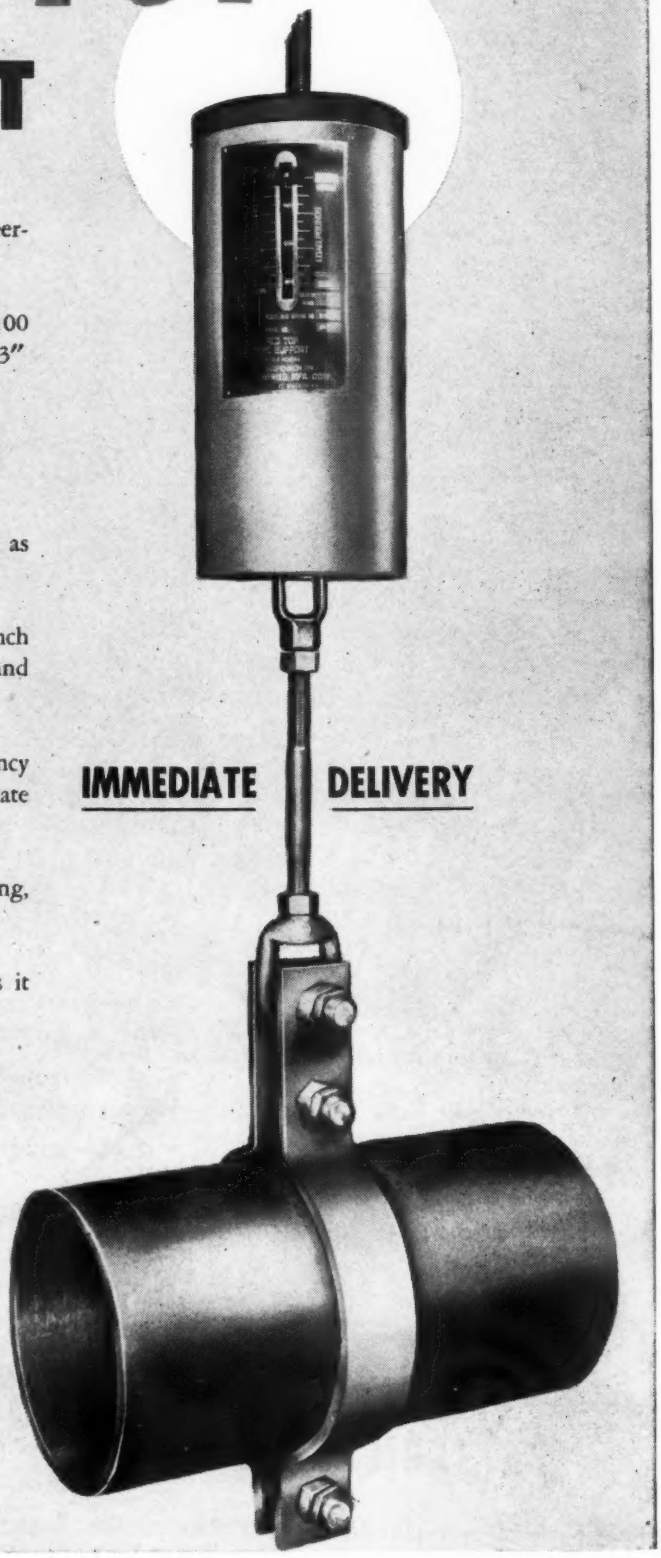
1888...Dependable Batteries for 60 Years...1948

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32 • *Exide Batteries of Canada, Limited, Toronto*

NEW! 1948 brings the 9 star

LEIBFRIED RED TOP*

PIPE SUPPORT



- Designed and standardized to meet modern engineering requirements at less expense.
- Three model sizes cover total load range from 100 to 5000 pounds, each size having travel range of 3"
- Easy selection of sizes from simple table.
- Low-priced and available immediately from stock.
- Easier and less costly to install properly, either as hangers or seats... no turnbuckles required.
- Variability, i.e. change of supporting force per inch of vertical travel movement, never exceeds 25% and may be as low as 14%.
- Actual load, travel, variability and natural frequency of vibration are all indicated instantly on scale plate for a given pipe position.
- "Cold"-load set is made in our shops, which setting, if desired, may be easily changed after installation.
- Neat appearance and compact. "Red Top" makes it easier to spot in service.

IMMEDIATE DELIVERY

A few choice sales territories are available.

Send for Catalog No. 316.

C. H. LEIBFRIED
Mfg. Corp.

PIPE SUSPENSION DIVISION
97-101 Guernsey St.,
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How Timken® bearings help Le Roi Airmaster last longer, work better

Timken bearings on crankshaft of Le Roi Airmaster compressor.

THE Le Roi Company of Milwaukee, Wisconsin, assures long life and minimum maintenance for their Airmaster Compressors by mounting the crankshaft on Timken tapered roller bearings.

Timken bearings hold the crankshaft in rigid alignment—free from deflection and end-play. They prevent wear on both the crankshaft and surrounding parts.

Since Timken bearings are tapered in construction they carry any combination of radial and thrust loads. The line contact between rolls and races provides a wide area of bearing support, preventing shaft deflection and affording maximum load capacity.

Timken bearings are manufactured to incredible precision. They retain that precision due to scientifically correct design and the finest material ever developed for tapered roller bearings—Timken fine alloy steel.

Over the years, the dependable performance and continued advertising of Timken bearings have made Timken-equipped products first choice throughout industry. Timken bearings in your product add a valuable sales feature. They build greater acceptance for your product among customers. When you specify tapered roller bearings for your product, specify "Timken". And when buying new equipment, always look for the trade-mark "Timken" on the bearings. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".

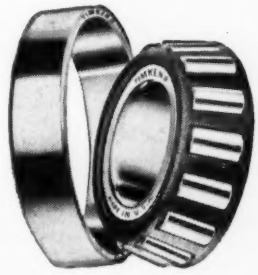
TIMKEN BEARING EQUIPPED

This symbol on a product means its bearings are the best.

TIMKEN BEARING CAPACITY RATINGS INCREASED 25%. Since Timken bearings were re-rated some 15 years ago there has been such a further and constant improvement in quality that we are now able to announce a 25% increase in radial and thrust load carrying capacity. This may make possible the use of smaller bearings with savings in bearing cost, material cost and weight. Engineers will be able to utilize the advantages of Timken bearings in more applications than in the past.

A new Timken Engineering Journal, now in preparation, will give you complete capacity rating tabulations. For further assistance, write us today.

TIMKEN
TRADE-MARK REG. U.S. PAT. OFF.
TAPERED
ROLLER BEARINGS



NOT JUST A BALL ○ NOT JUST A ROLLER ○ THE TIMKEN TAPERED ROLLER ○ BEARING TAKES RADIAL ○ AND THRUST ○ LOADS OR ANY COMBINATION

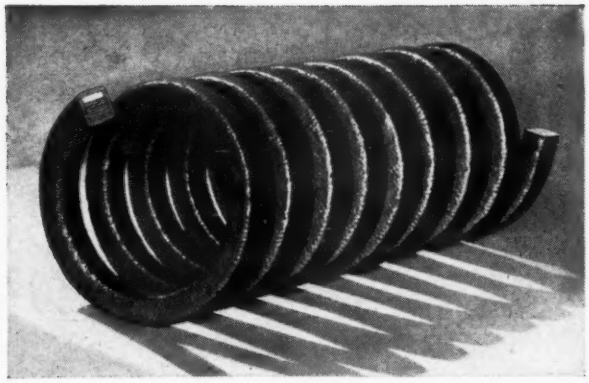
GP

Good Prescription

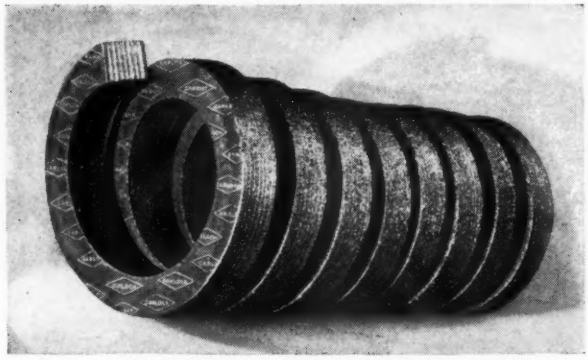
FOR YOUR PACKING PROBLEMS

A good practical prescription for packing troubles is to specify GARLOCK. The three rod packings illustrated are typical of the many fine *quality-controlled* packings in the GARLOCK line. Also specify GARLOCK gaskets and KLOZURE oil seals for long, dependable service.

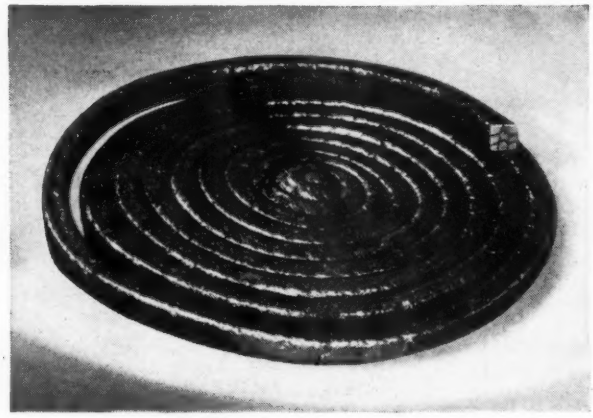
THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK
In Canada: The Garlock Packing Co. of Canada Ltd., Montreal, Que.



GARLOCK 150 Asbestos High Pressure Steam Packing

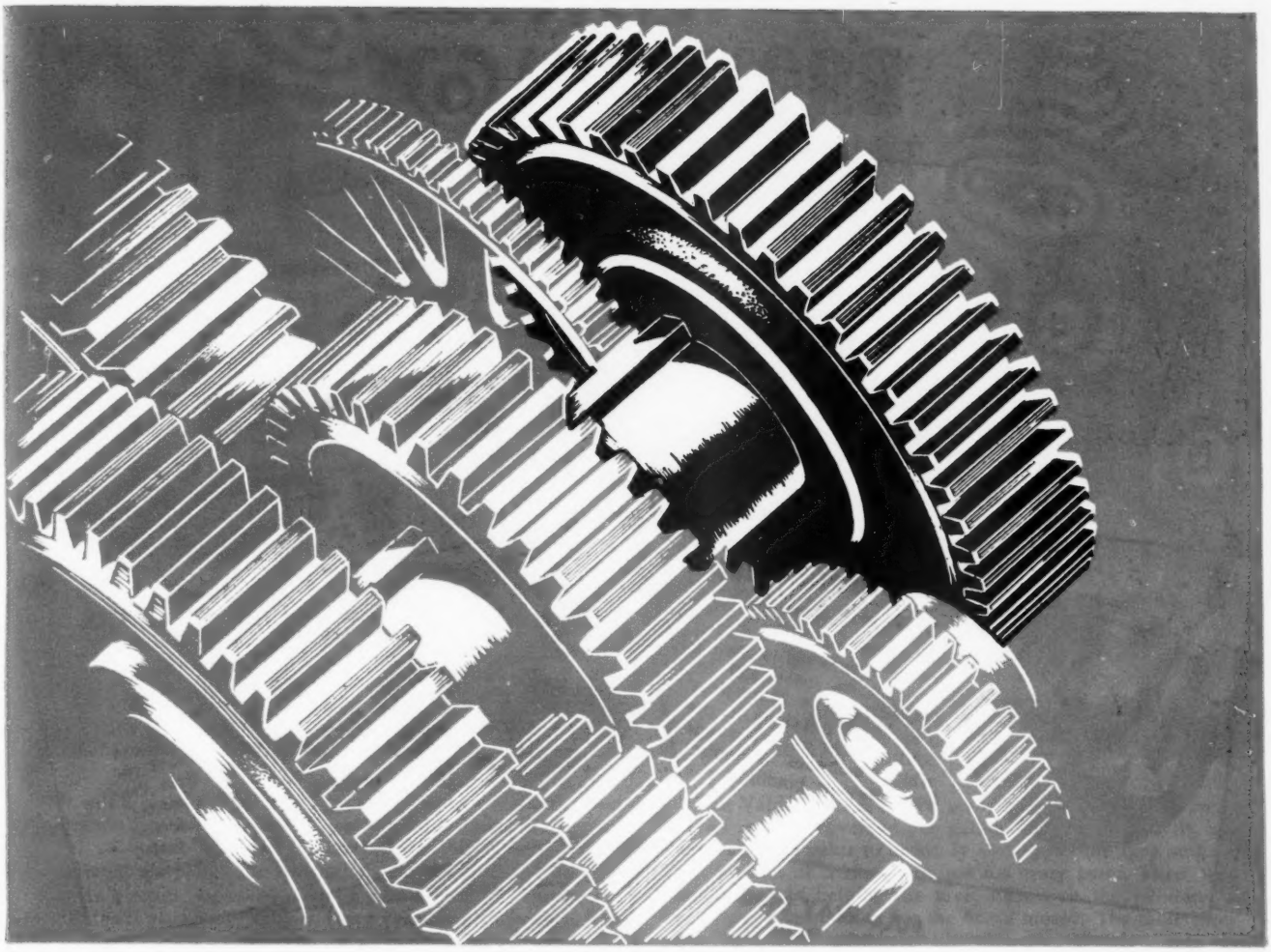


GARLOCK 777 Rubber and Duck Low Pressure Packing



GARLOCK 90 Waterproof Hydraulic Flax Packing

YES! Tycol "Engineered Lubrication" performs better . . . BETTER . . . BETTER



Tycol Engineered Lubrication performs better because:

. . . *Tycol Engineered Lubrication* supplies the scientific answer to every lubricating need in industry—from spindle oils for textile plants to roll neck greases for steel mills.

. . . *Tycol Engineered Lubrication* boosts production by promoting efficient, smoother-running machine operation . . . there's a Tycol oil or grease "engineered" for your specific job.

. . . *Tycol Engineered Lubrication* slashes costs by prolonging equipment life, protecting it against wear and tear . . . repair bills and "down time" are invariably reduced.

Let Tide Water Associated help you select the best lubricant for your particular need. Write, wire or phone today to your nearest Tide Water Associated Office for full details.

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INDUSTRIAL LUBRICANTS

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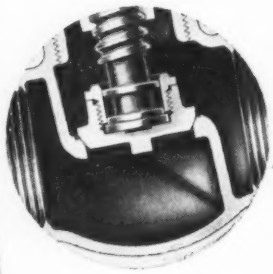
17 BATTERY PLACE · NEW YORK 4, N.Y.

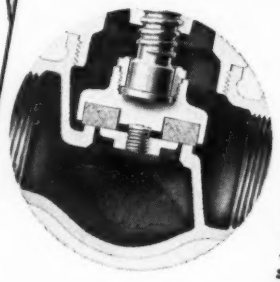
LUBRICATION—"ENGINEERED TO FIT THE JOB"

Guide for Selecting KENNEDY BRONZE GLOBE VALVES



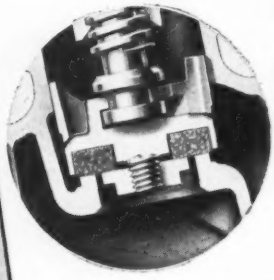
BRONZE DISC
Screwed Bonnet

This valve is designed for standard pressure, general service. Like all Kennedy Bronze Globe and Angle Valves this type can be repacked under pressure when wide open.



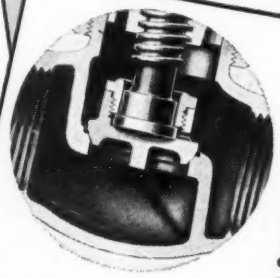
RENEWABLE COMPOSITION DISC
Screwed Bonnet

The discs in these standard-pressure valves are built to standard dimensions . . . those carried in stock by all supply houses. Kennedy offers various compositions . . . each selected to meet specific operating conditions. The exceptionally high raised seat assures longer disc life.



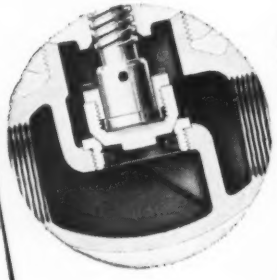
RENEWABLE COMPOSITION DISC
Union Bonnet

The convenient Slip-on Disc Holder speeds up renewing the disc on these 150 lb. Kennedy valves. This holder is accurately guided in the body by four guided prongs which maintain alignment and prevent binding.



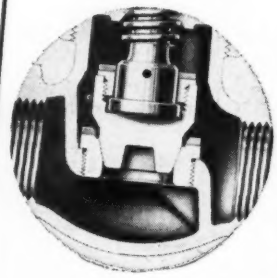
REGRINDING DISC
Union Bonnet

The discs of these 125 lb. and 200 lb. valves are designed to permit repeated regrinding . . . without removing the valve from the line. The body, bonnet, union bonnet ring and disc are made of the same metal as used for 300 lb. Kennedy valves.



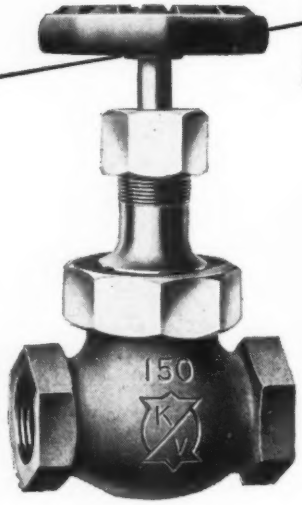
FULL-WAY DISC
Union Bonnet
Renewable Seat Ring

These 200 lb. and 300 lb. valves have renewable discs and seat rings of tough, wear resisting nickel-copper alloy. They can be furnished in special alloys to meet unusually severe service conditions.



PLUG-TYPE DISC
Union Bonnet
Renewable Seat Ring

The extra wide seating surfaces of these 200 lb. and 300 lb. Kennedy valves make them highly resistant to wire drawing. The plug-type disc design assures precise throttling control. Nickel-copper alloy for discs and seat rings are standard. Special alloys for unusual service conditions are available.



In addition to these bronze globe and angle valves, the extensive Kennedy line also includes bronze gate and check valves, iron body gate, globe, angle and check valves, malleable iron and bronze screwed fittings, and cast iron flanged fittings and flanges.

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KENNEDY

valves • pipe fittings • fire hydrants

THE KENNEDY VALVE MFG. CO., ELMIRA, N. Y:
Offices and Warehouses in Principal Cities

KV-169

I Discovered This New Money Saving Way to Select Paints!

FREE Specification Booklet
shows how to—Select Paint for best results on each surface . . . Prevent over-ordering and underestimating needs. Lists Paint characteristics—as to acids, caustics, heat, abrasion, moisture, etc.
PRESERVING THE MATERIALS MANKIND HAS WRESTED
VALDURA
HEAVY DUTY PAINTS

It was a lucky day for me when I got the new Valdura Specification Booklet—on heavy-duty painting. I found it so practical, so easy to use, that it gave me valuable benefits when I selected the paints for renovating our plant.

As a result, we saved many dollars on the job. But best of all, we'll save many dollars every year on maintenance. This *Valdura Specification Booklet* shows the most serviceable paint to use for *every kind* of application in every industry.

Gives All the Answers—This amazing Valdura booklet lists every kind of surface that needs paint for maintenance. It shows just which kind of primers and finish coats give the best results for each surface. There's no chance of selecting the wrong paint. These recommendations are based on intensive research by Valdura's laboratories and on proved results of many thousands successful applications.

The Valdura Chart solved many other problems for me. It shows average coverage per gallon—so I knew exactly how much of each paint to order. It also shows the type and correct amount of thinner required for every paint. These were big factors in helping me save dollars on the job—and in getting the most value for the firm's money. The table showing product characteristics like moisture, abrasion, acid and caustic resistance, oil and heat was also a valuable help.

Can Save You Money—Yes, it was a lucky day for me and for my firm when I discovered the new Valdura Chart on heavy-duty painting. No wonder I say, "Send for your free copy of this amazing chart. It shows you how to save on paint jobs and cut maintenance costs. It helps you select paints that look better, last longer and improve working conditions!" Mail the coupon now!

Charts Now Ready For These 10 Industries

Bakeries
Breweries
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Canning Plants
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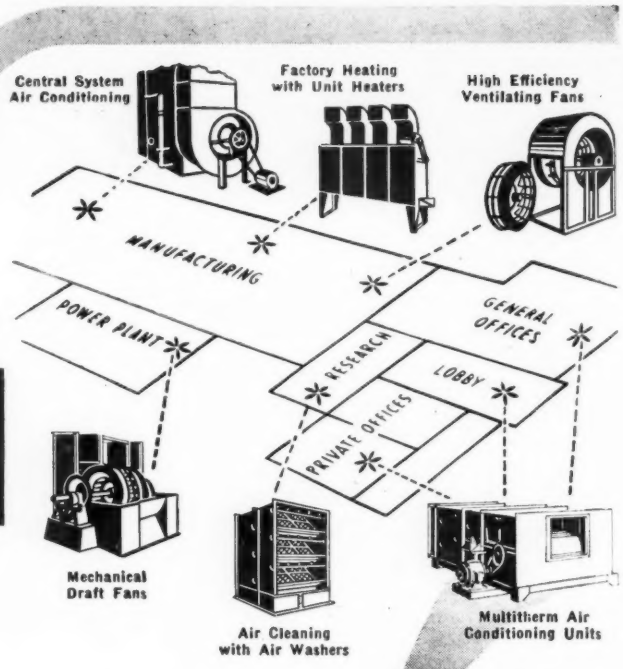
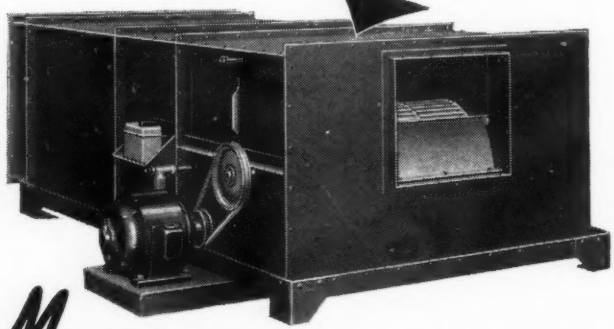


THERE'S A **CLARAGE** UNIT FOR EVERY NEED IN EVERY TYPE OF BUILDING



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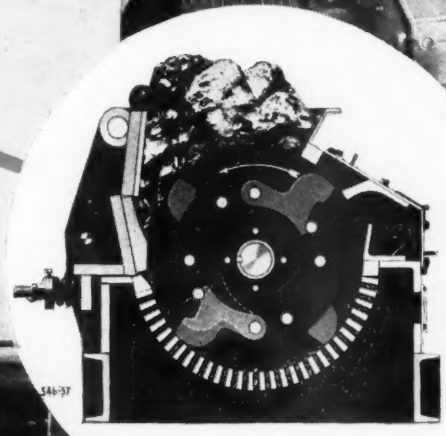

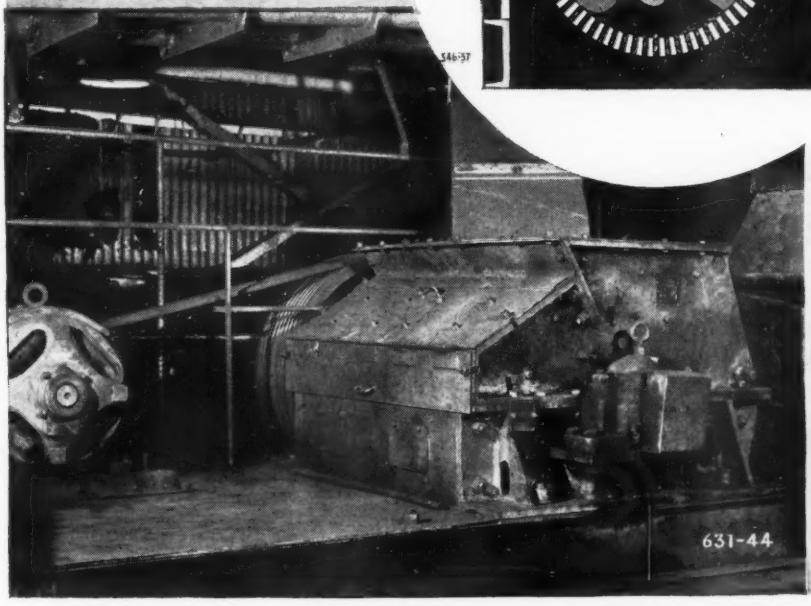

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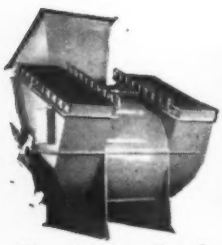
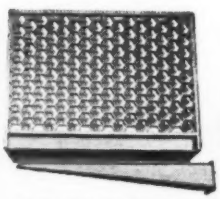


HS and Sirocco Fans for forced or induced draft in all types of power plants.



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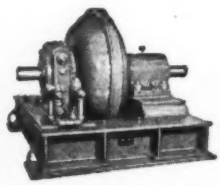

Type VS Gyrol Fluid Drive—for adjustable speed control of mechanical draft fans.

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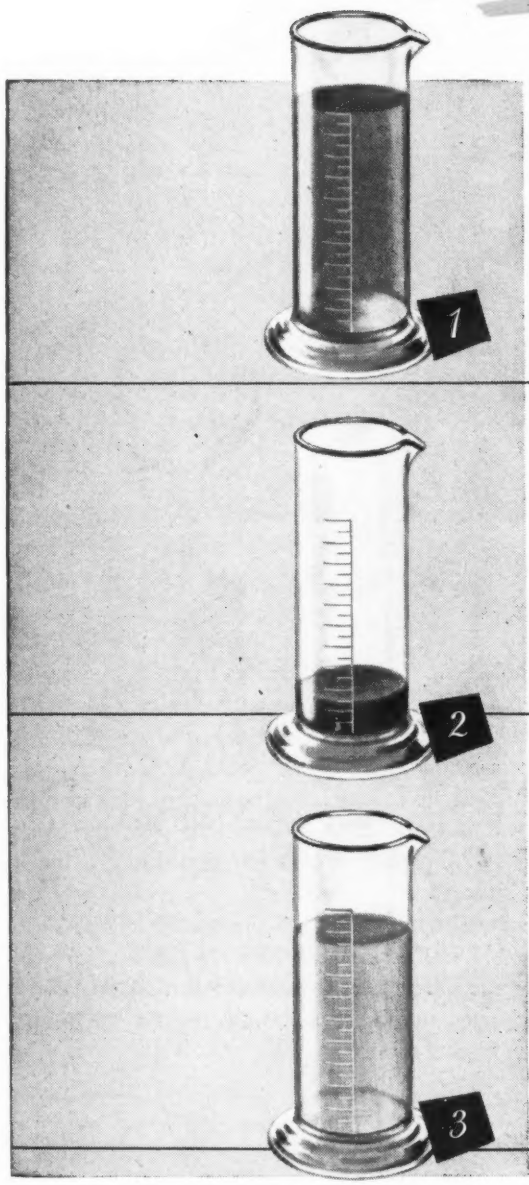
GULFCREST is the only turbine oil that gets this *extra refining**



Gulfcrest is the only turbine oil that's Alchlor-processed.* This is an extra refining step. It makes Gulfcrest extra pure and extra efficient.

In Cylinder 1 you see the oil that will become Gulfcrest. It has already gone through the usual steps used in refining other turbine oils—but has not yet been Alchlor-processed.*

In Cylinder 2 you see the part—approximately 15%—discarded by the Alchlor Process.* This is the part that, when allowed to remain in turbine oil, is most likely to oxidize, increase neutralization number, and form sludge, emulsifiers, and harmful acids.

In Cylinder 3 you see the finished Gulfcrest—the incomparably pure lubricating oil that gives outstanding performance and helps keep steam turbine systems clean indefinitely. To make it even finer, special inhibitors are added to it—they give it still greater stability and protect against corrosion.

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Call in a Gulf Lubrication Engineer today and ask him to recommend the proper grade of Gulfcrest Oil to meet the specific requirements of your turbines. Write, wire, or phone your nearest Gulf office.

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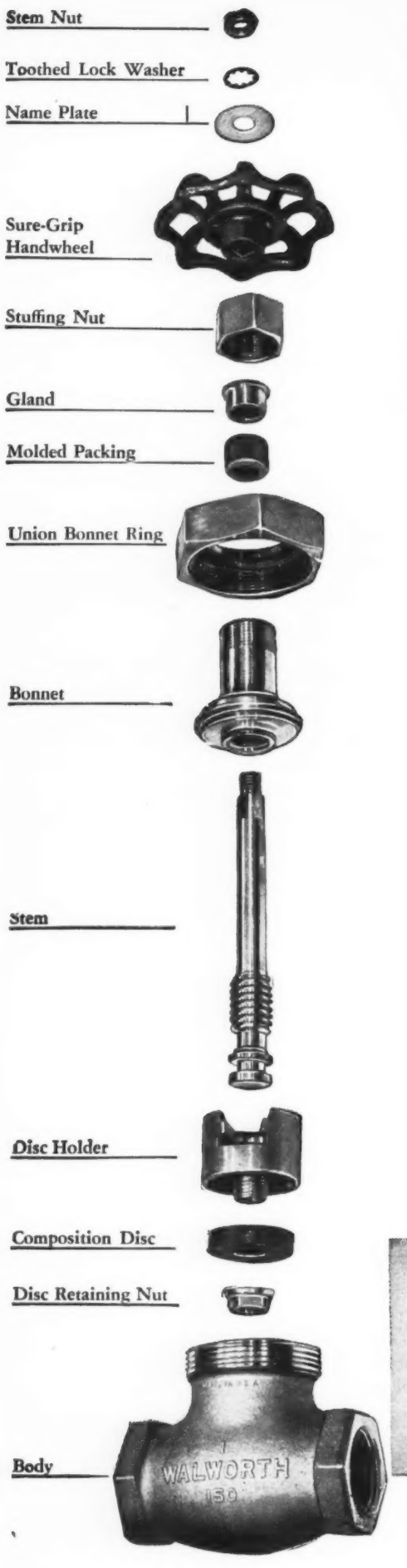

TO MAKE A GOOD VALVE BETTER

Walworth has redesigned and improved its No. 95 Quality Bronze Globe Valve.

150 pounds working steam pressure at 500F

300 pounds cold water, oil, or gas.

Can be repacked under pressure when fully opened.

The Walworth No. 95 Bronze Globe Valve has always been tops with piping men because they liked these features: Renewable composition disc; lock-on, slip-off disc holder; union bonnet construction; deep stuffing box; tough bronze body made of Composition M (ASTM B61).

Now Walworth has added these improvements: (1) New cylindrical disc holder that accurately guides the disc to the seat, regardless of the position in which you install the valve. (2) Newly designed, air-cooled, sure-grip handwheel that you can grab and turn, even when wearing greasy work gloves. It has a tapered square hole sized to gage to fit snugly on the finished square of the stem. (3) Toothed lock-washer to prevent the stem nut from becoming loose. (4) All parts have been redesigned to give maximum service and strength.

Walworth Quality Bronze Valves are available in Globe (No. 95), Angle (No. 96), or Check (No. 97) types and in sizes from ¼ to 3 inches (check valves ¼ to 2 inches). Ask your Walworth distributor to show you the improved Walworth No. 95 Bronze Valve, or write for further details.

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valves and fittings

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ROBINS CONVEYORS HELP SET NEW BULK MATERIALS-HANDLING RECORDS!

Stretching down the 700-foot-long pier at Curtis Bay in Baltimore are these four Robins conveyors.

Together they can load two ships at a time with 17,500 tons in less than 1 hour and 45 minutes. That's 10,000 tons an hour! No wonder this Robins installation has set new records for speed and efficiency!

You can be sure of speed and efficiency when you use Robins Conveyors to move coal, ore, limestone, etc. That's because every Robins Conveyor is designed, engineered and built by a single source—Hewitt-Robins! It's the only organization in the world that offers you a *complete* conveyor system . . . and takes full responsibility for *all* elements.

You see, your Robins Conveyor is engineered with idlers, pulleys and drive built by Robins. You benefit by these three exclusive advantages of Robins Idlers: (1) *One-Shot Lubrication*—requires only half the time and only one walkway. (2) *Triple-Grease Seal*—seals grease in, locks dirt out. (3) *Rigid Truss Construction*—stronger than any other type of construction.

The belting of your Robins Conveyor is built by Hewitt. The strong, durable cover of this belting is made of shock-absorbing rubber which withstands extreme gouging, tearing and abrasion . . . resists moisture and mildew.

Little wonder then, that Robins Conveyors can help you move your bulk materials more quickly . . . more economically!

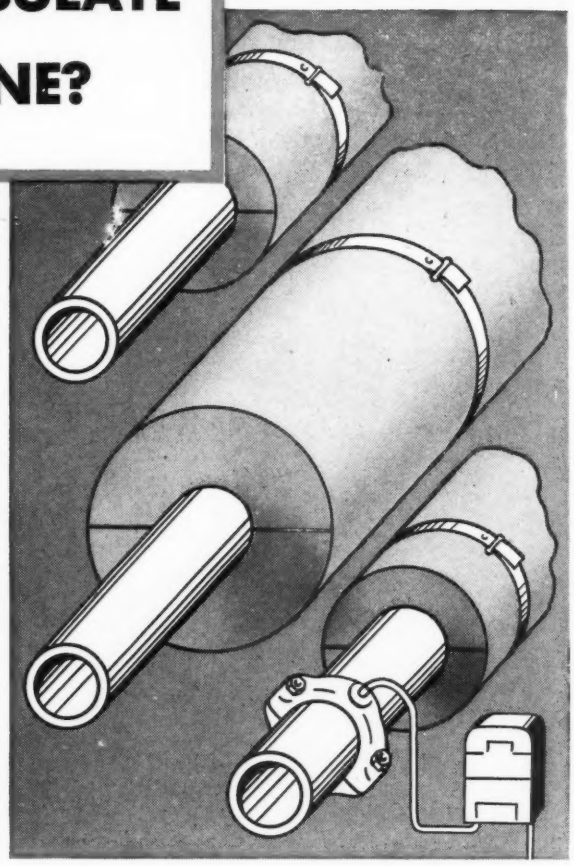
ROBINS

CONVEYORS

Find out how Robins Conveyors can help you do *your* job faster, better, cheaper. Write to Robins Conveyors Division, 270 Passaic Avenue, Passaic, New Jersey.

ROBINS CONVEYORS DIVISION **HEWITT-ROBINS INCORPORATED**

HOW WOULD YOU INSULATE THIS HOT LIQUID LINE?



A 3" line running 100' through a 75° F. room carries a hot, viscous fluid at 225° F., flowing continuously at the rate of 40' per minute. Temperature of the fluid at the delivery end must not drop more than 5° F. How would you hold the proper temperature in the line?

- ☐ Standard thick 85% Magnesia
- ☐ 3-inch thick 85% Magnesia
- ☐ External heat source and Standard Thick Magnesia

Here's what the Armstrong engineer recommended:

In industries where control of process temperatures is vital to successful operation, insulation can be designed to help hold those temperatures accurately. Writing the specification that best meets the requirements of the job calls for careful study of all factors involved, as well as a thorough knowledge of just what insulation can do and its limitations.

In the problem outlined above, with the liquid flowing through the pipe continuously, the Armstrong engineer calculated that 3" of 85% Magnesia would hold the temperature to within the allowable 5° of 225° F., at the delivery end of the 100' run of pipe.

However, on jobs where pipe runs are long and flow is intermittent, no practical amount of insulation will prevent a viscous liquid from cooling and solidifying in the line. Under these conditions, an external heat source, such as charging the line with a low voltage or running a steam tracer, should be used. These methods also need insulation to operate efficiently.

Whether you need insulation to make a process work, or to cut heating or power costs, Armstrong engineers are well qualified to help you arrive at the right specification for the particular job. And the complete contract service for heat insulation offered by Armstrong also includes a full line of top quality materials and skilled workmen to apply them.

FREE INSULATION CHART

This chart lists types and thicknesses of insulation for temperatures from 300° below zero to 2800° F. Write today to Armstrong Cork Company, Industrial Insulation Department, 7008 Maple Ave., Lancaster, Pennsylvania.

ARMSTRONG'S INDUSTRIAL INSULATION

Complete Contract Service For All Temperatures

From 300° Below Zero

To 2800° Fahrenheit

"Water Treatment? .... for this?"

THE BIRD-ARCHER 8-POINT WATER TREATMENT SERVICE

All or any part of this service is available to you

1. *Study of all available water sources*
2. *Plant survey*
3. *Laboratory Service for scientific analysis*
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5. *Instructing plant staff in the operation and control of the treatment system*
6. *Furnishing properly prepared treatment materials*
7. *Specifying any equipment necessary*
8. *Regular check-ups by service engineers*

BA-128

The scissors grinder uses water to help him put an edge on his customer's cutlery . . . and to soak his feet at night. Water Treatment will hardly help him, but . . .

There are other uses to which water is put . . . *important* uses, such as industrial cooling and processing, and for generating power. That's where Bird-Archer Water Treatment *can* help . . . for corrosion and scale can be costly.

A difference in efficiency often means an important difference in operating costs . . . That's where Bird-Archer Service *proves* its value.

The Bird-Archer *8-point* Service, born of 60 years of experience solving water treatment problems, will sharpen up efficiency, grind down operating costs, and stretch the life of water and steam handling equipment. Ask to have a Bird-Archer representative furnish full details.

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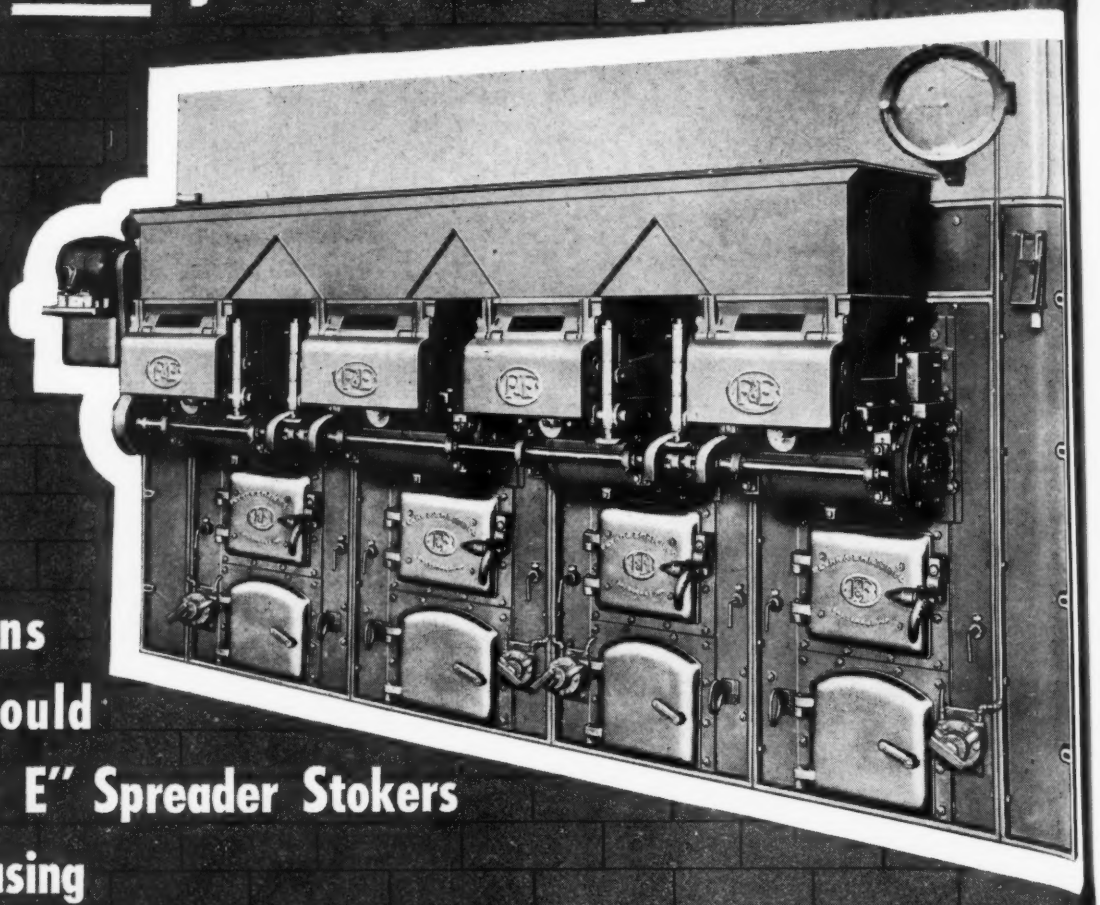
CALDERAS Y ACCESORIOS, S. A. AMSTERDAM 291, MEXICO, D. F.

Why this *isn't* just another Spreader Stoke



Three reasons why you should consider "F & E" Spreader Stokers before purchasing that new stoker equipment.

1) "F & E" ELECTRO-HYDRAULIC DRIVE—self-contained; minimum of working parts, all encased operating in a bath of oil. Completely safeguarded against breakdowns due to tramp iron or other foreign materials being fed in with the coal; no gears, ratchets, sheer pins, etc. Any number of coal feeds from minimum to maximum.

2) "F & E" ALTERNATE PUSHER COAL FEEDERS—the pushers of each coal feeder are made in four sections; of the step pusher design, these pusher sections cover the entire hopper bottom. They operate in alternate directions, that is while two sections are advancing forward, two sections are receding backward and vice versa—thus providing a continuous discharge of coal upon the distributors and assuring non-clogging, dependable and continuous coal feed.

3) "F & E" INCREMENTAL CONTROL VALVE—regulates operation of the hydraulic drive; lends itself perfectly to automatic control; instantly transfering to the coal feeding mechanism, the regulating action of the automatic controls and this with the complete elimination of shafts, racks and complicated mechanism.

It takes experience to design and build such a stoker, and the "F & E" Spreader Stoker reflects years of identification with the stoker business. If you want top performance in your next stoker installation, specify the "F & E" Spreader Stoker. Write today for Illustrated Bulletin No. 1301.

FLYNN & EMRICH COMPANY

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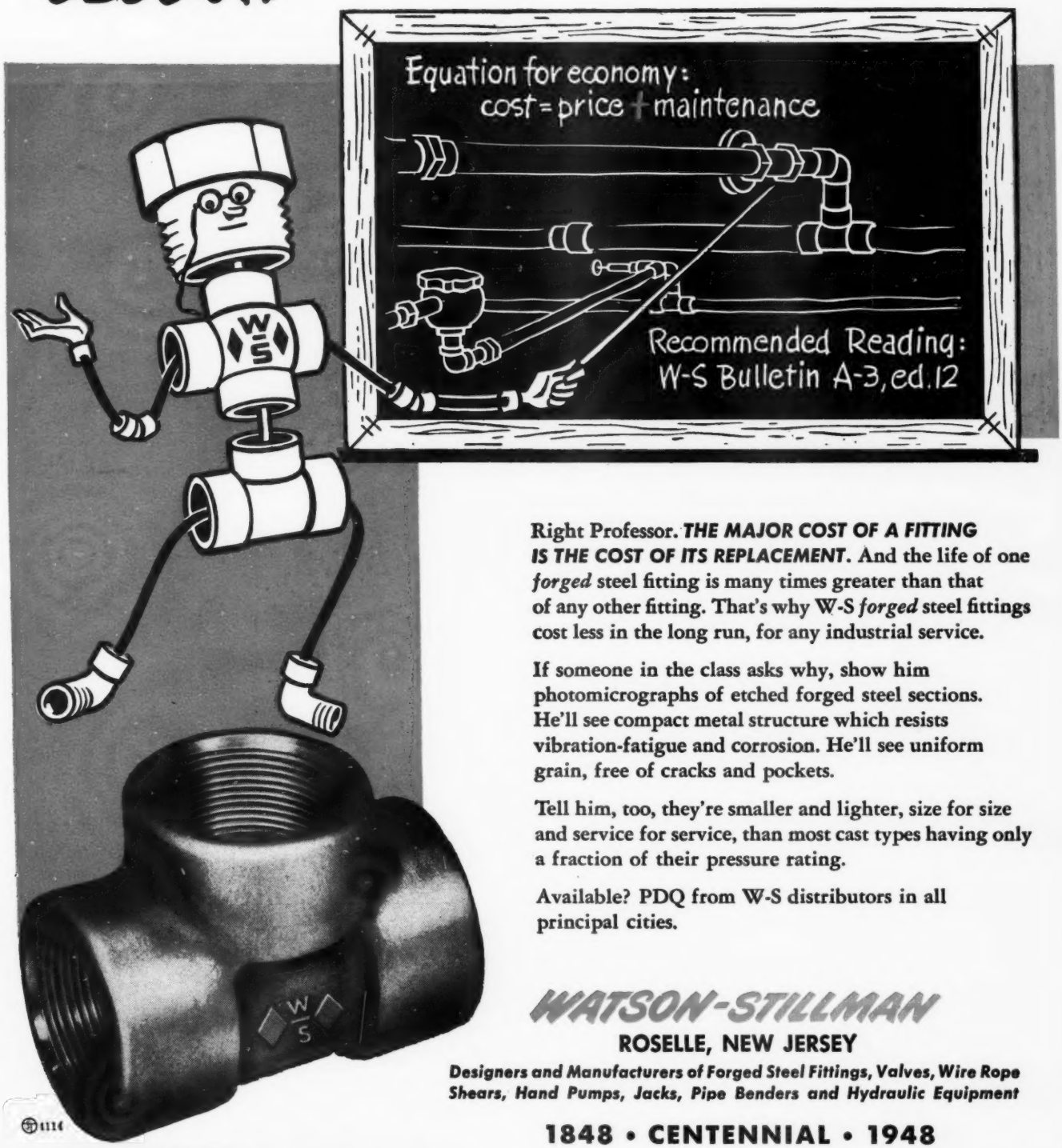
A FITTING LESSON

FORGED FITTINGS LAST



Right Professor. ***THE MAJOR COST OF A FITTING IS THE COST OF ITS REPLACEMENT.*** And the life of one *forged* steel fitting is many times greater than that of any other fitting. That's why W-S *forged* steel fittings cost less in the long run, for any industrial service.

If someone in the class asks why, show him photomicrographs of etched forged steel sections. He'll see compact metal structure which resists vibration-fatigue and corrosion. He'll see uniform grain, free of cracks and pockets.

Tell him, too, they're smaller and lighter, size for size and service for service, than most cast types having only a fraction of their pressure rating.

Available? PDQ from W-S distributors in all principal cities.

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Designers and Manufacturers of Forged Steel Fittings, Valves, Wire Rope Shears, Hand Pumps, Jacks, Pipe Benders and Hydraulic Equipment

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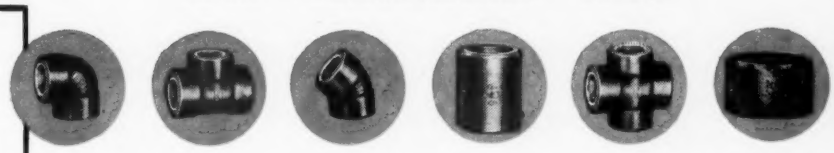
Low Sulphur, Low Phosphor
High Tensile, High Weldability

ALLOYS
Stainless types 304—316—347
Chrome Moly—Carbon Moly—
Chrome Carbon Moly—Monel
Special alloys for Low Temperatures



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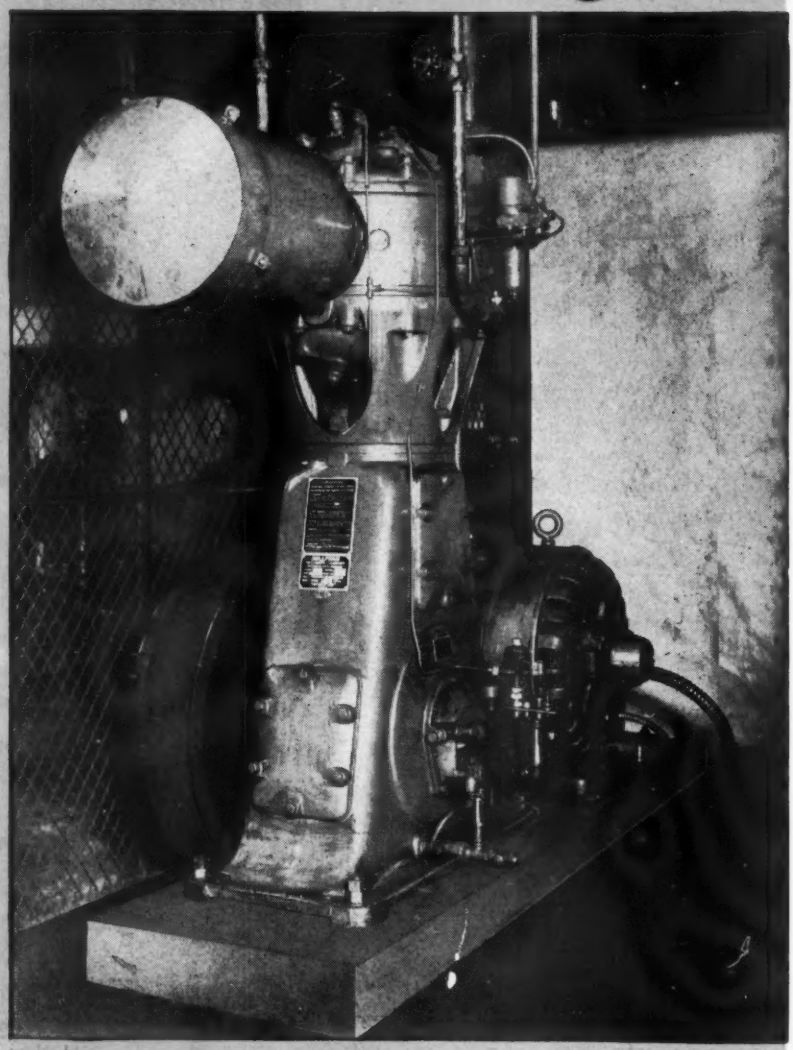
JOY WG-9 HEAVY DUTY AIR COMPRESSOR

11 SIZES
20 TO 150 P.S.I.
153 TO 822 C.F.M.



Because of its smooth running characteristics and the small base area of the rugged semi-steel frame, only a small block-type foundation is needed, making the Joy WG-9 an ideal installation where space is at a premium. Yet, despite this small space requirement, the WG-9 is built for heavy duty, continuous, 24 hour a day service, and incorporates such features as full force-feed lubrication, anti-friction main bearings and long-life "Dual Cushion" valves.

CYLINDER LINERS REPLACEABLE ON THE JOB

Consult a Joy Engineer

W&D 1-1309

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COPPER ALLOY BULLETIN

MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company "Bridgeport" BRASS CO. *Headquarters for BRASS, BRONZE, and COPPER*

Lengthening Tube Life in Power Plant Auxiliary Equipment

Power plant engineers are under constant pressure on the one hand for ever-increasing output, and on the other for lowest possible cost. Many years ago, turbines and auxiliary equipment were, in most cases, seldom under more than partial load. Today it is taken for granted that equipment will be operated at full capacity. Where surface condensers formerly were operated for about two days continuously with one day off, they now operate for long periods without interruption.

The drive for greater efficiency is reflected, for example, by the conservation of all possible heat through such procedures as the use of condensate to remove heat from hydrogen and turbine oil (the condensate later being added to boiler feed water); boiler blowdown heat exchangers to utilize heat from water to be discarded; vent condensers to utilize the heat from waste gases; and others.

Most operators realize the important part that auxiliary equipment plays in maintaining profitable operations throughout the plant.

Where there is no severe corrosion problem, the tubing used in such equipment gives satisfactory service for many years. However, in some cases auxiliary equipment is subjected to corrosive conditions ranging from somewhat severe to extremely severe, and here, use of the most suitable tubing alloy will obviously result in the greatest efficiency and longer life.

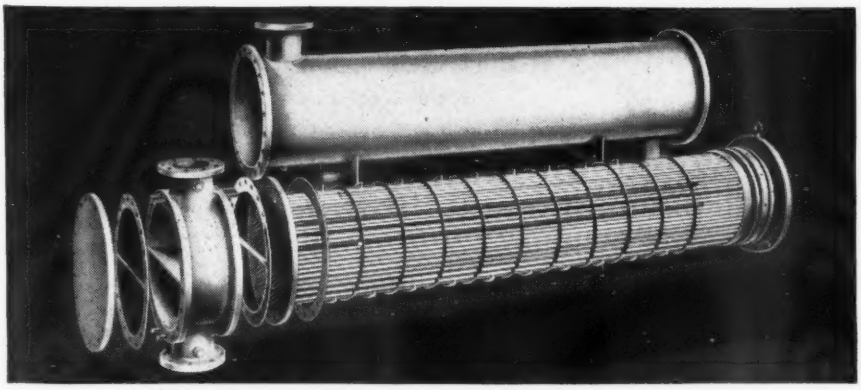
Lube Oil Coolers

In most cases, lubrication oil coolers and turbine oil coolers present no serious corrosion problems. There is little trouble from the oil side, and, where clean, fresh cooling water is used, standard condenser tube alloys such as Admiralty, Muntz Metal, Red Brass and Copper give years of satisfactory service. This also applies where condensate is used to cool lubricating oil. However, where sea water is used, more corrosion-resistant alloys, such as Aluminum Brass, Duronze IV (arsenical aluminum bronze), and 70-30 Cupro Nickel have given good service. Selection of the alloy depends upon the water conditions involved.

After Coolers

In some cases the desirability of using more corrosion-resistant tubing in after coolers may be overlooked. These units, which cool the air bled out of the condenser from the steam side, utilize cooling water from the same source as the condensers. The compositions of the gases on the outside of the tubes is often another factor to be reckoned with. It is, of course, necessary for after coolers to operate at top efficiency and maintain a high rate of heat transfer in order to handle as great a volume of air as possible. Such alloys as Admiralty, Aluminum Brass, Duronze IV (arsenical aluminum bronze) and 70-30 Cupro Nickel have been successfully used in this application.

Generally speaking, the same tubing alloy which gives satisfactory service in the condenser should also stand up well in the after cooler.



Lubricating Oil Cooler—Courtesy Graham Manufacturing Co., Inc.

Evaporators

Tubing used in these units, which remove objectionable dissolved and suspended solids from incoming feed water, must be able to withstand the action of salt-laden water (in the case of sea water) on one side and steam on the other side of the tubes. For salt water, 70-30 Cupro Nickel has been used in increasing quantities and Duronze IV (arsenical aluminum bronze) appears to have great promise.

For evaporating fresh water, Copper, Admiralty, Red Brass and Muntz Metal are standing up satisfactorily. Selection and maintenance of evaporator tubing is discussed in the February, 1948, Copper Alloy Bulletin.

Feed Water Heaters

Despite the fact that boiler feed water does not present too much of a corrosion problem for copper and copper-base alloys, there are other factors to be considered, such as the wide range of pressures and temperatures and accelerated corrosion due to steam impingement and vibration. 70-30 Cupro Nickel, Admiralty, Muntz and Copper Tubing are used, depending upon operating conditions. See Copper Alloy Bulletin, April, 1948.

Vent Condensers

Tubing in vent condensers is subjected to extremely severe corrosive conditions. As steam is bled off from one of the later stages in the turbine and into the deaerator, various gases rise into the vent condenser. The feed water which is being heated by these gases and is flowing on the inside of the tubes presents no serious corrosion problem. Red Brass, Muntz and Admiralty are generally satisfactory. However, where corrosion on the gas side is exceptionally severe, Duplex Tubing with aluminum or stainless steel to the gas side and a copper-base alloy to the water side is under consideration.

Analyze Corrosion Problems

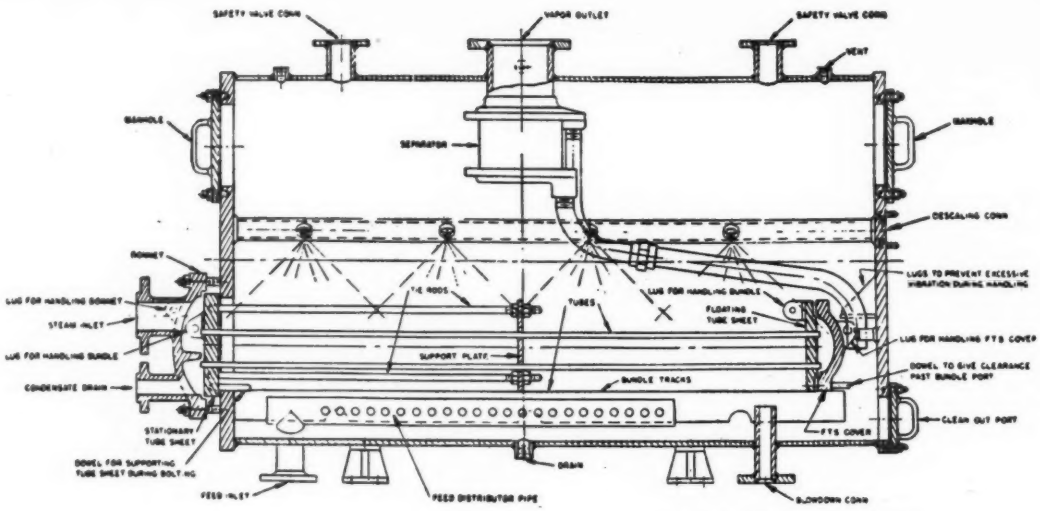
It will pay power plant operators to give their auxiliary equipment the benefit of a searching examination and careful periodic inspection to determine what corrosive conditions are involved, just as is done for main condensers. Such units have an importance out of proportion to their small size, since a breakdown may result in costly shutdowns. Bridgeport's laboratory will gladly help along those lines and try to determine which of the tubing alloys will give the best service.

Contact the nearest Bridgeport office for information regarding laboratory service and write for Bridgeport's 120-page Condenser Tube Manual. It is full of valuable information about condenser tubing, ways of increasing tube life, methods of installing, corrosion data and specifications.

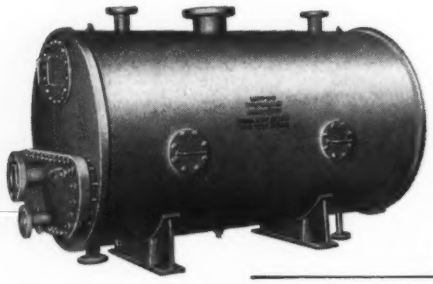
BRIDGEPORT BRASS

BRIDGEPORT BRASS COMPANY, BRIDGEPORT 2, CONN. • ESTABLISHED 1865

Mills at Bridgeport, Connecticut, and Indianapolis, Indiana • In Canada: Noranda Copper and Brass Limited, Montreal



Sectional elevation of a
Lummus Power Plant Evaporator



adequately designed—

for operation and maintenance

Pure water from any raw or salt water supply

Lummus experience . . . in designing and fabricating power plant evaporators to meet individual requirements . . . is your guarantee of a dependable supply of pure water from any raw or salt water source.

Full-efficiency operation is assured by a soundly based design that provides adequate vapor separators and liberal, properly balanced disengaging areas. Easy maintenance is assured by a practical understanding of field conditions. All connections are readily accessible and do not require disassembly within the unit to remove the tube bundle.

Lummus engineering service is always available for the study of specific heat exchanger problems and equipment design to meet individual power plant conditions. May we give you further information?

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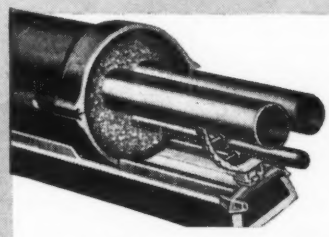
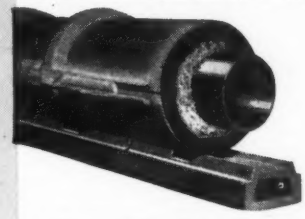


Standard Tile—for all normal ground load conditions.



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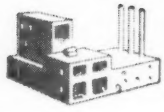

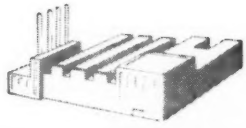

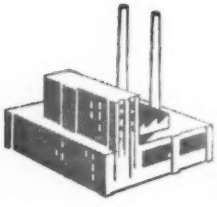

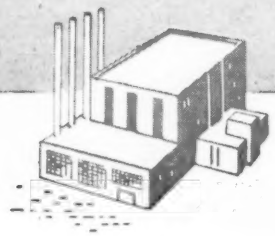

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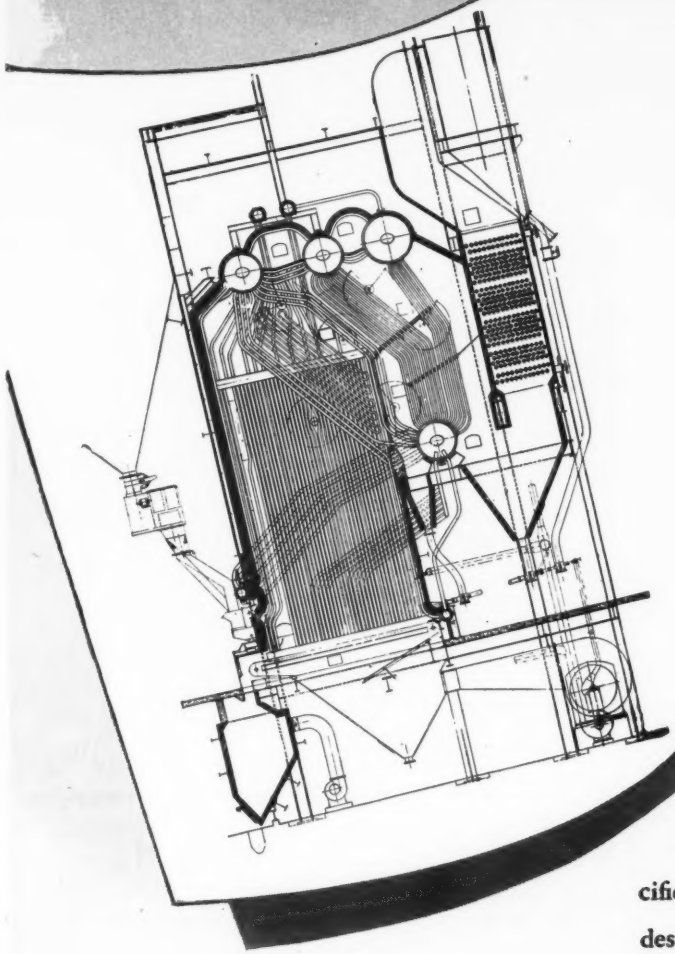

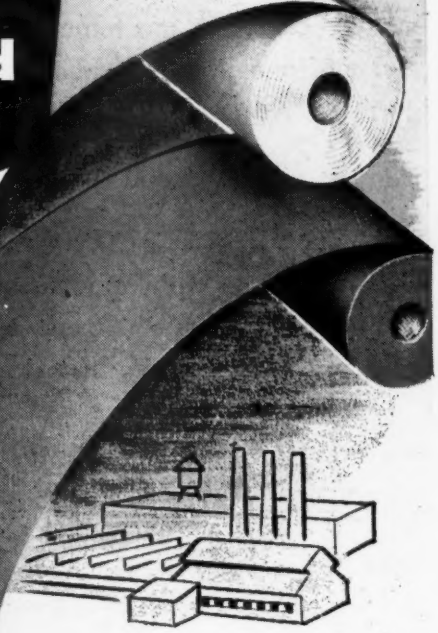

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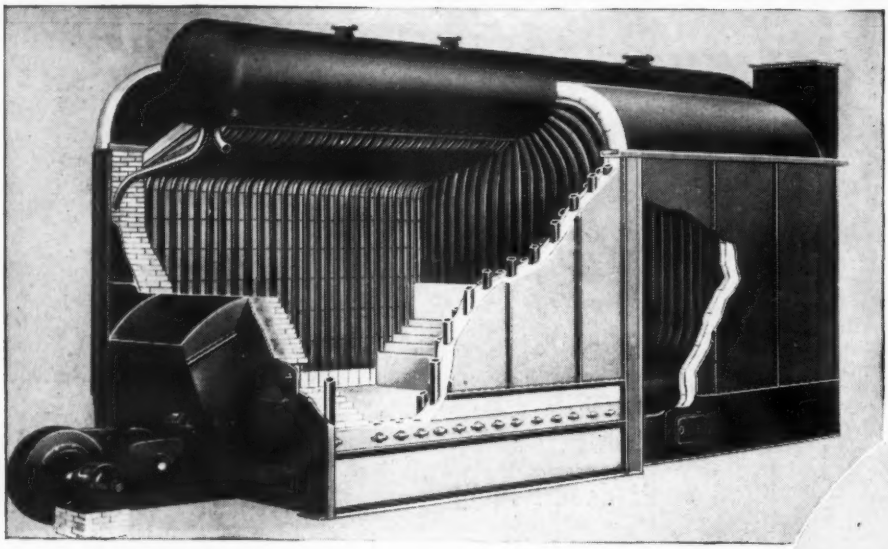

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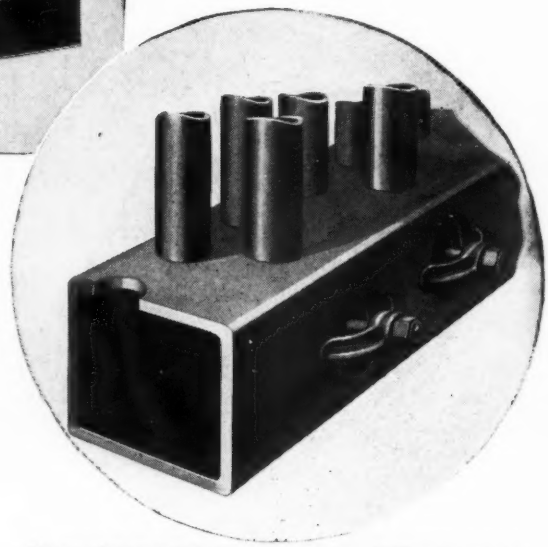

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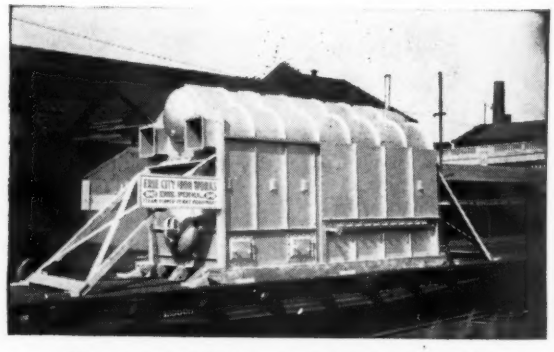

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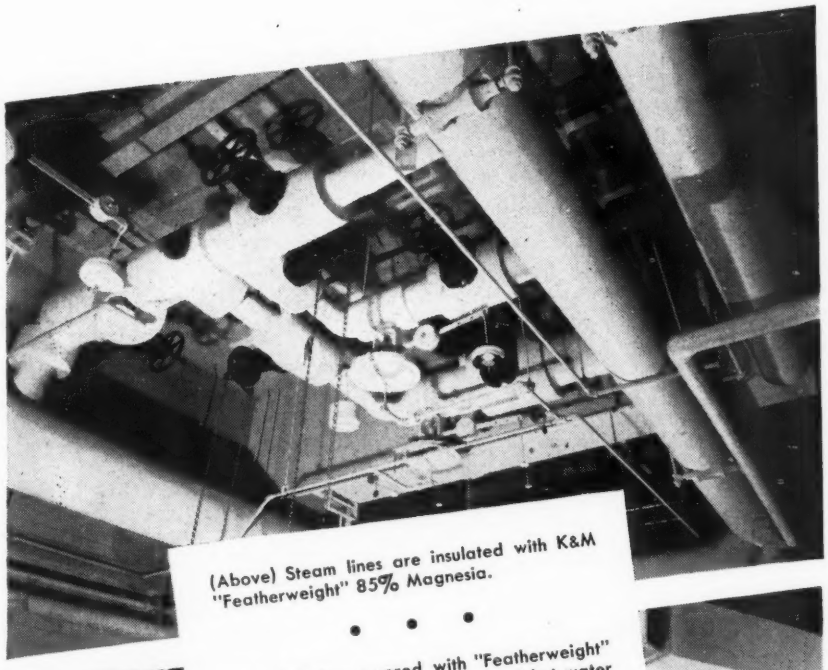

(Above) Steam lines are insulated with K&M "Featherweight" 85% Magnesia.

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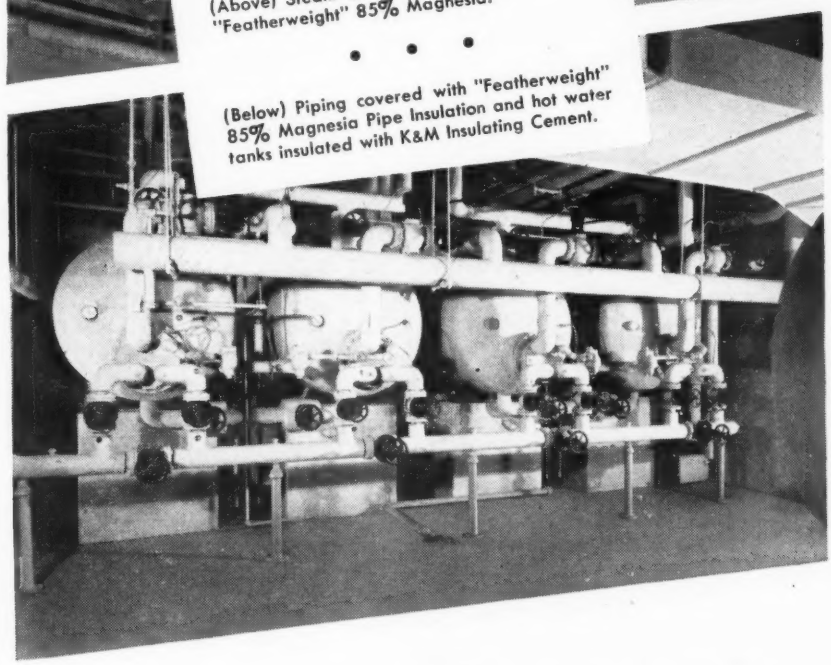
(Below) Piping covered with "Featherweight" 85% Magnesia Pipe Insulation and hot water tanks insulated with K&M Insulating Cement.



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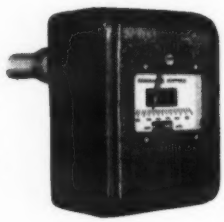

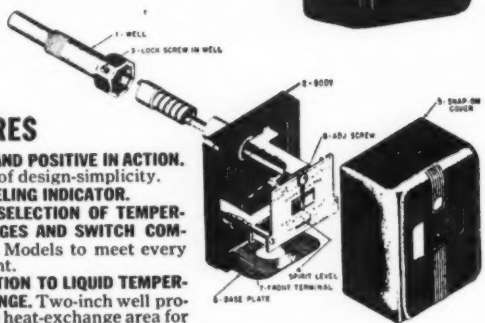

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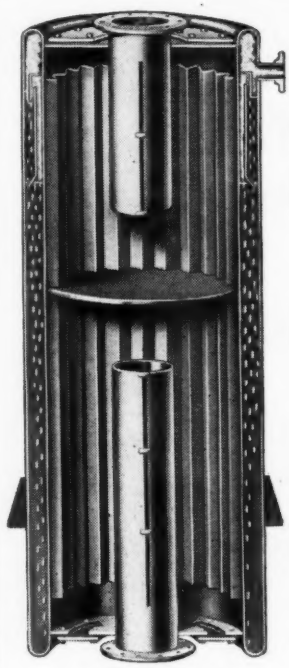

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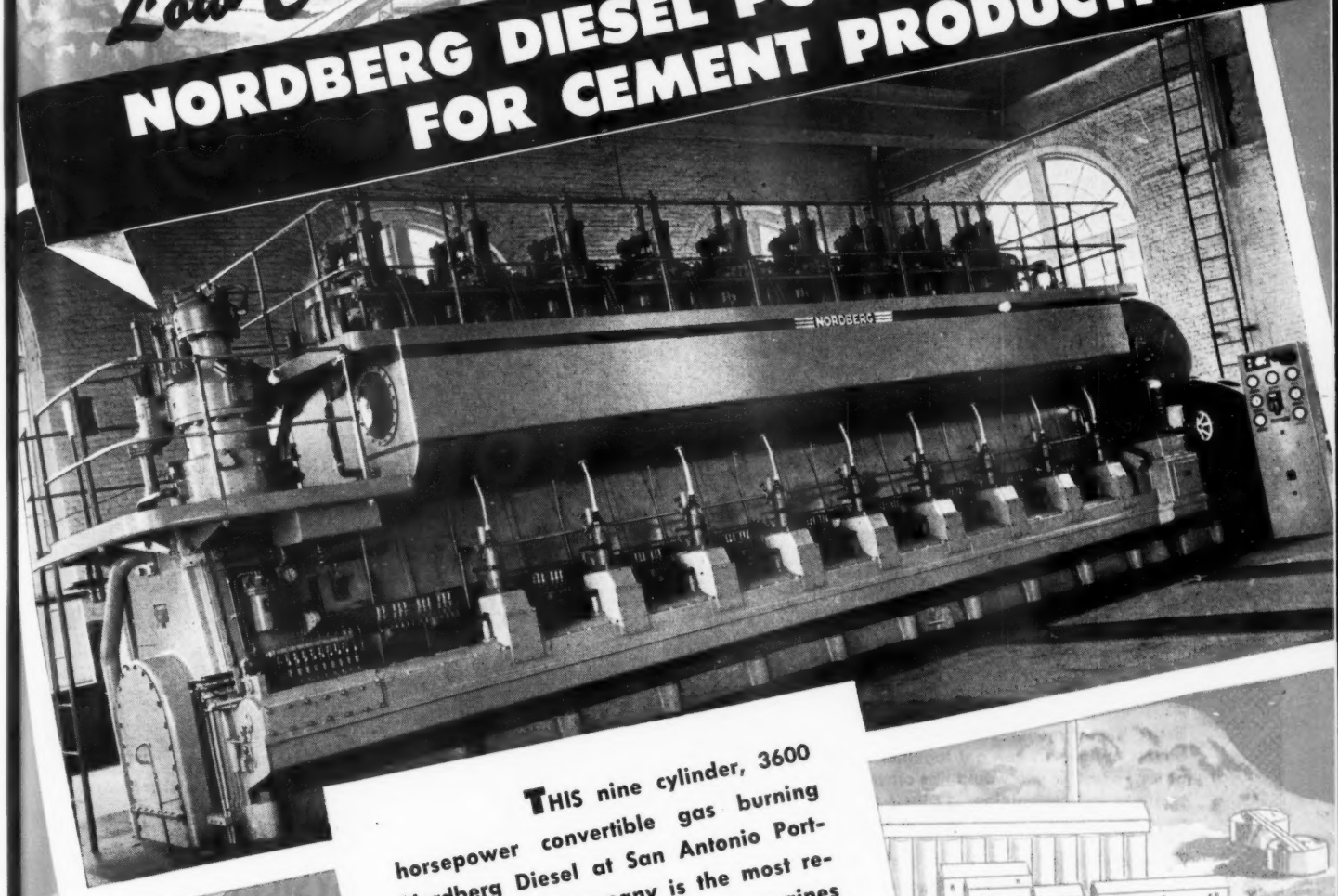

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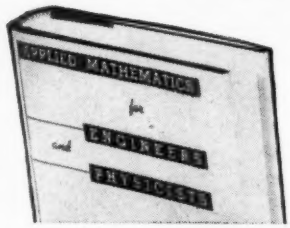

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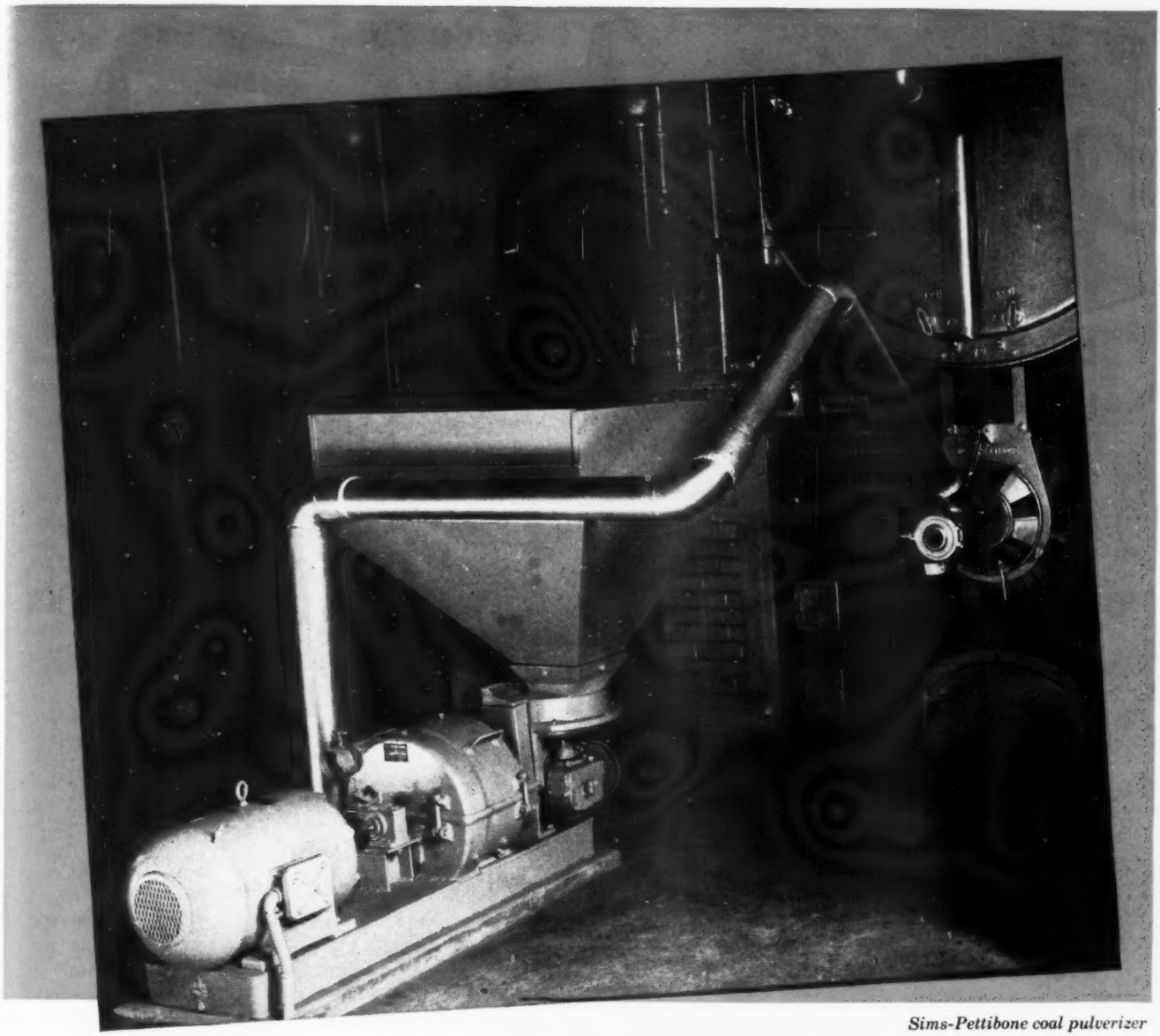

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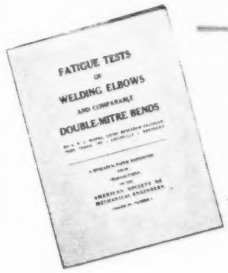

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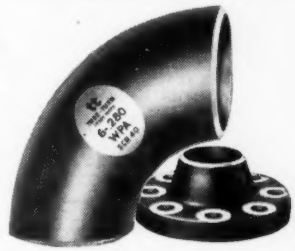

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Retrol is a highly activated adsorbent manufactured specifically for the re-refining, decolorizing, purifying and filtering of used oils.

Re-refining with Retrol does the entire money-saving job—using proven petroleum refinery principles—distillation, adsorption and filtration.

Send for free booklet—"American Industry Speaks."

Re-refine with RETROL*

*Reg. U. S. Pat. Off.

FILTROL CORPORATION
634 South Spring Street
Los Angeles 14, California

Please send me your book entitled "American Industry Speaks."

Company_____

Name of Individual_____ Title_____

Address_____

City_____ Zone_____ State_____

F—12A

IF IT'S here...

IT'S news...

IT'S WORTH STOPPING TO SEE!

Maybe Industry doesn't maintain show windows on Fifth Avenue or State Street or Wilshire Boulevard like America's great department stores. But your industry has a mighty effective show window... *and this is it*... this magazine. In these advertising pages alert manufacturers show their wares. Here you will find up-to-the-minute news about products and services designed to help you do your job better, quicker, and cheaper. To be well-informed about the latest developments in *your* business, *your* industry... and to stay well-informed... *read all the ads too.*

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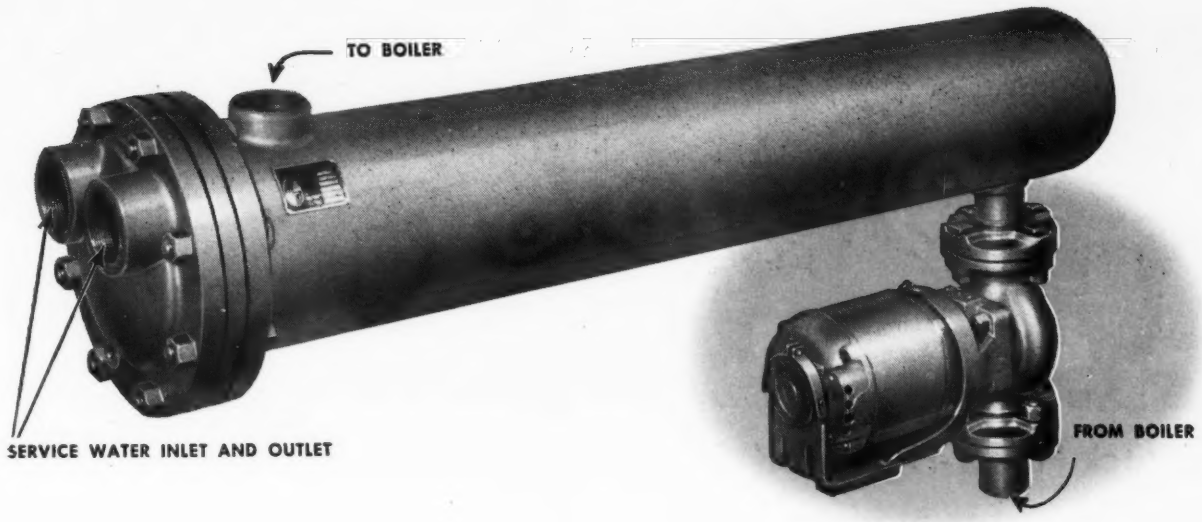


NEW KIND OF WATER HEATER

PRODUCES MORE HOT WATER . . . CONTROLS TEMPERATURE

The B & G Type "WU" Instantaneous Water Heater (water to water heat transfer) is equipped with a B & G Booster which pumps boiler water through the properly baffled shell, thereby greatly increasing the capacity of the Heater. Large volumes of hot water are produced by an amazingly small unit.

Slashes material and labor cost!

Because of pumped circulation, the connecting pipes and fittings are radically reduced in size. Hence, material cost is trimmed to the bone and cutting and threading can be done on the job. No storage tank needed—another substantial saving.

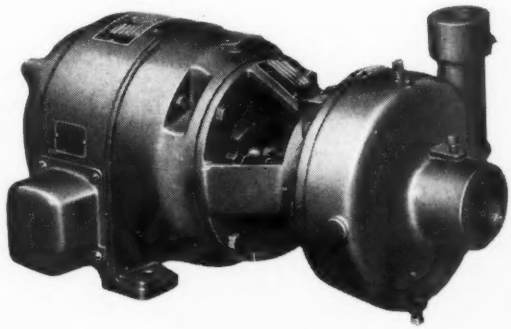
Controls service water temperature!

The Booster also provides a means of closely controlling service water temperature. A hot water control, installed in the hot service water supply line, starts the Booster whenever service water temperature goes below the desired degree. The Booster pumps boiler water through the shell of the Heater *until service water is again at the correct temperature.*

Write for capacity and dimension data.

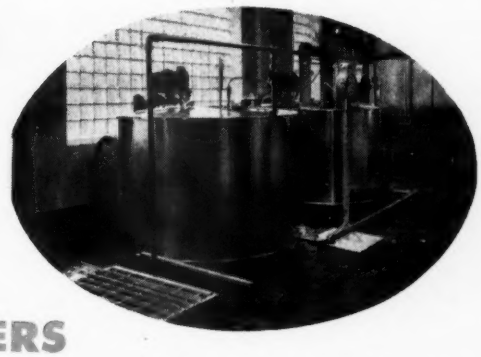
B & G SERIES 1522 CENTRIFUGAL PUMP

Here's pump performance that astonishes engineers and maintenance men! Seven outstanding features—Standard Motors — Mechanical Seal — Spring-type Flexible Coupling — Interchangeable Parts — Compact Design — Easy to Service — Competitive Price. Write for catalog.



B & G REFRIGERATION COMPONENTS

B & G manufactures a complete line of Condensers and Chillers — unit illustrated is the Series CRF Condenser. Engineering data furnished on request.



BELL & GOSSETT COMPANY
Dept. AQ-36 Morton Grove, Illinois

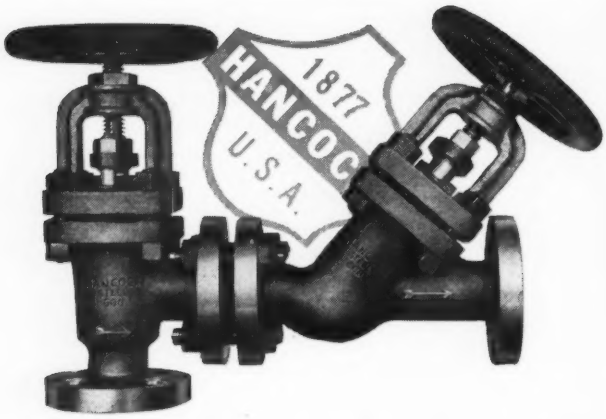
Hydro-Flo WATER HEATERS

. . . CENTRIFUGAL PUMPS . . .

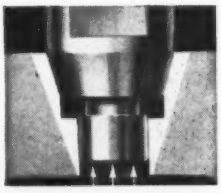
REFRIGERATION COMPONENTS

B & G Heaters furnish low-cost hot water for process work in plants the country over.

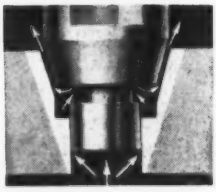
*REG. U. S. PAT. OFF.



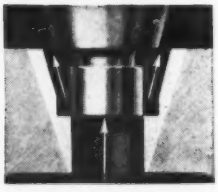
Hancock "Blow-Deflector" Blow-Off Valves for modern boilers



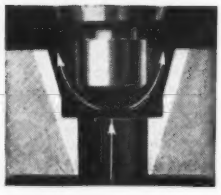
Valve seat and disc in closed position. Pressure from the boiler is indicated under the valve disc.



As the valve starts to open, a small amount of water shoots upward . . . it hits the protecting lip and washes harmlessly across the seat as the valve is opened further.



When the piston leaves its guide the seating surface of the disc is completely out of the line of flow. This makes it impossible for the velocity of the water to cut the seating surface of the disc.



This shows valve in open position. Note that neither shut-off surface is affected by the flow.

Integral *Stellite* faced seats, and "500 Brinell" "Blow-Deflector" stainless steel discs, assure a permanent installation for the life of the boiler. 300#—600#—1500#—2500# scope of design.

Stocked and sold by leading Distributors everywhere. Write to them or to us for full information.

MAXWELL MANNING M&M MOORE INC. TRADE MARK

HANCOCK *Valves*

A Product of

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Makers of Hancock Valves, Ashcroft Gauges, Consolidated Safety and Relief Valves and 'American' Industrial Instruments. Builders of 'Shaw-Box' Cranes, 'Budgit' and 'Load Lifter' Hoists and other lifting specialties.

The World's Fastest

complete boiler tube service!

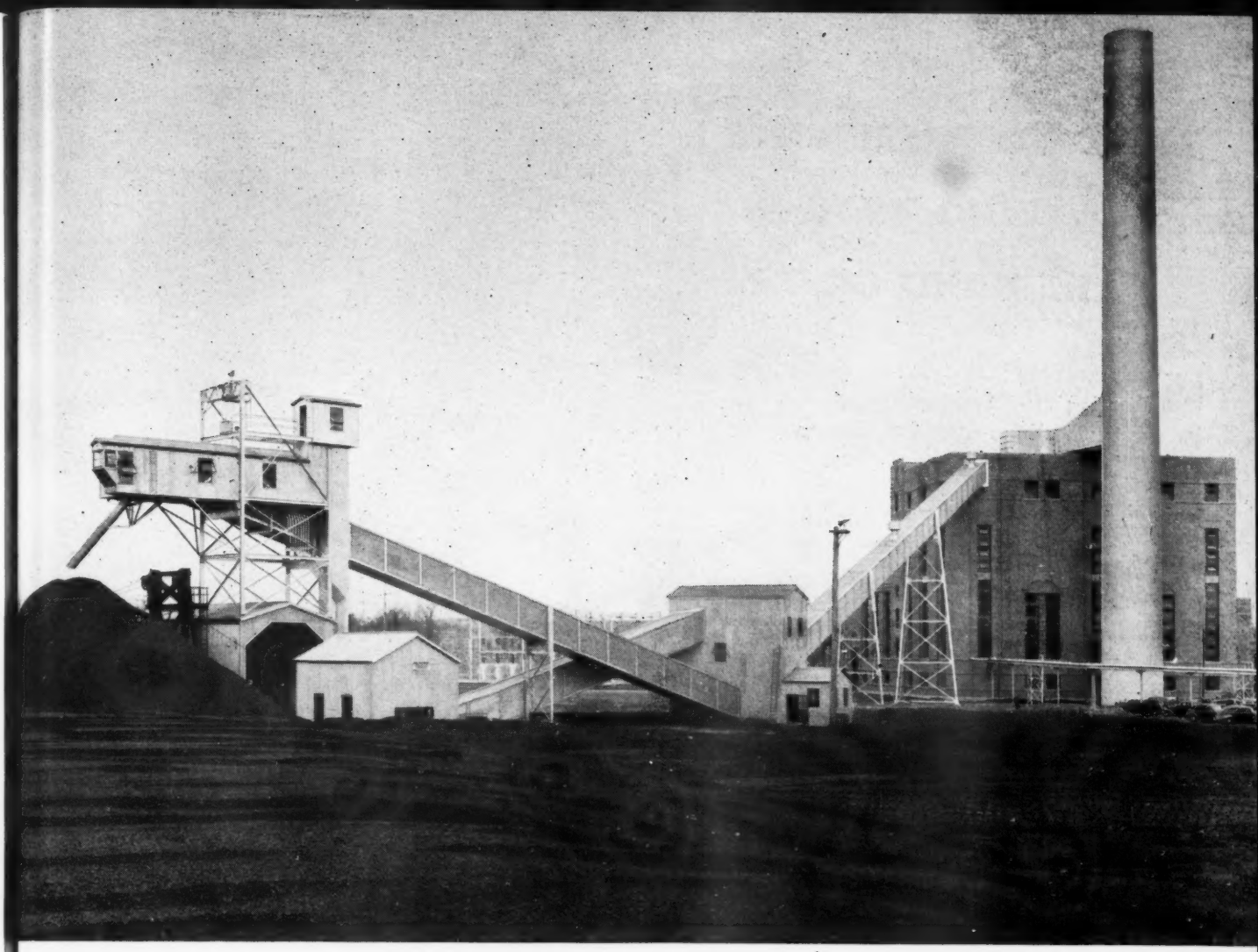
BOILER TUBE CO. OF AMERICA

McKEES ROCKS, PA. (Pittsburgh District)

PITTSBURGH · CHICAGO

FRED S. RENAULD & CO., LOS ANGELES

2



Central Station Coal Handling

BARTLETT-SNOW Central Station Coal Handling Equipment is adapted to receiving coal by rail, over waterways or by truck. Complete facilities are available including track hoppers; belt, apron, reciprocating and duplex feeders; belt conveyors and belt trippers; crushers, pulverizers, screens and automatic samplers; bins, bunkers and distributing conveyors dust hooded and vented if desired; also ship hoists, favored when space is limited—complete with all control equipment, synchronized and coordinated into a complete, efficient, economical unit.

At the Bryce E. Morrow Station of the Consumers Power Company near Comstock, Mich., pictured above, the cars are dumped 400 ft. from the plant, inside a sheet metal house. The coal is fed from the 18′ wide by 38′ long track hopper onto a 36″ inclined belt conveyor, with twin belt feeders, having capacities of about 100 tons per hour each, carried to the crusher house and passed over a magnetic pulley into the ring roll crusher.

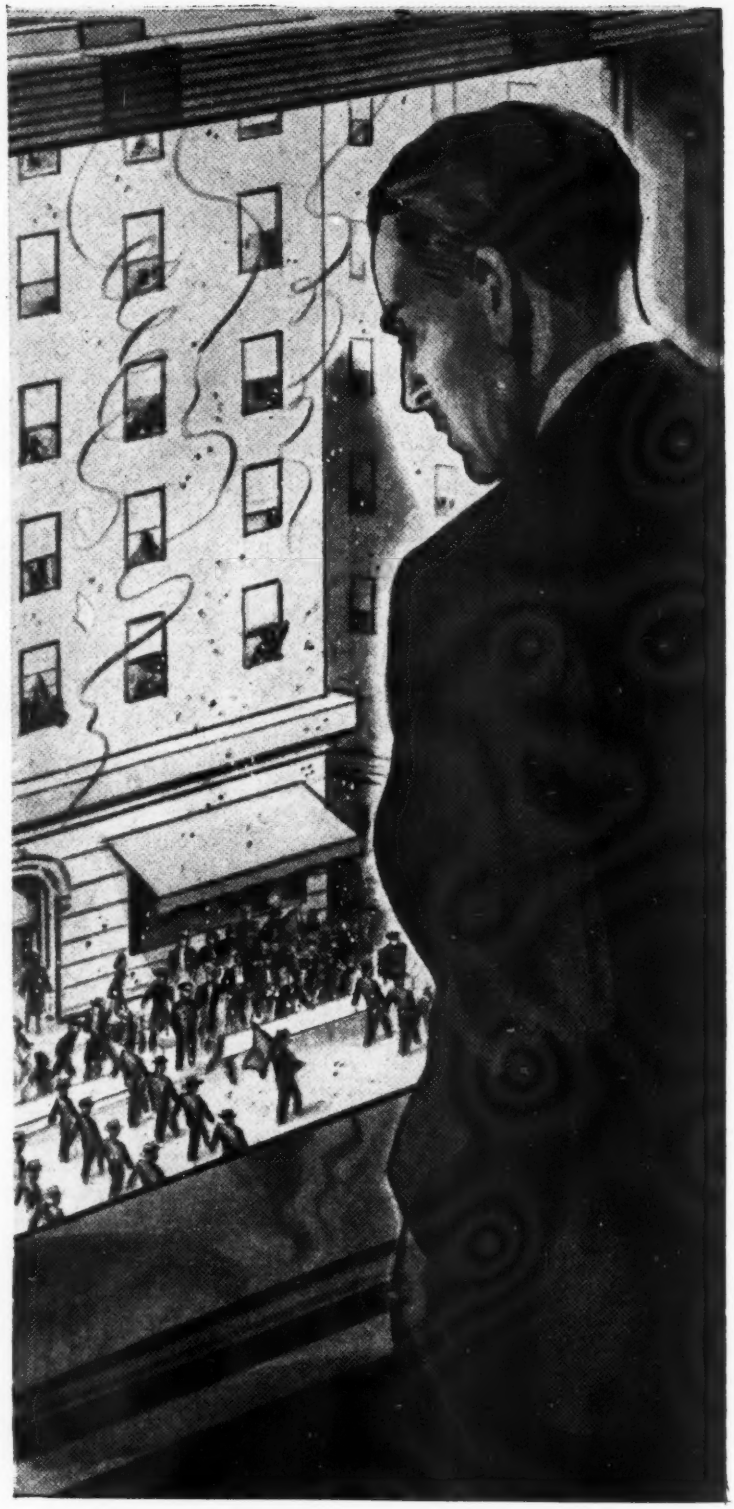
Crushed coal for the bunker passes up a 325′ belt conveyor over a weightometer to a flight conveyor, enclosed in a dust-tight housing kept under suction, that distributes the coal to the bunkers with practically no dust loss at all. Coal going to storage is carried up an inclined belt, discharged to the initial pile, stored, and reclaimed through the receiving equipment.

Let the Bartlett-Snow engineers with their long and exceedingly successful experience in central station coal handling, work with you on your next coal handling job. The C. O. Bartlett & Snow Company, Cleveland 5, Ohio. Engineering representatives in New York, Baltimore, Detroit and Chicago.

BARTLETT-SNOW
CLEVELAND 5, OHIO

COAL HANDLING SYSTEMS
for
CENTRAL STATIONS AND INDUSTRIAL BOILER PLANTS

MEMO TO PRESIDENTS WHO WATCHED THE BAND GO BY!



HERE'S ONE parade that isn't "all over but the shouting" after the band has passed. It's the Payroll Savings Plan for the regular purchase of U.S. Security Bonds by employees.

Though the formal spring campaign to sell Bonds is over, any company can still move forward with the parade. Right now thousands of companies are putting *additional push* behind their Payroll Savings Plans. Managements of many companies that have not yet participated are *now installing* the Plan.

It's a "look-ahead" plan, that benefits employee, company, and nation. Every $3 invested in Bonds pay $4 at maturity. Personnel records in the plants with active P.S.P. programs show improved employee attitudes—evidenced by less absenteeism and fewer accidents—as the individual's sense of security grows with Bond purchases. And every Security Bond dollar built up in the Treasury retires a dollar of the national debt that is potentially inflationary. It means less bidding-up of prices. Moreover, Bond buyers are better citizens because they have a tangible stake in the nation's future.

It's just as easy to take action now as when the campaign was at its height. Just call your Treasury Department's State Director, Savings Bonds Division, and ask for the material that helps to get a Payroll Plan started or to keep it rolling.

The Treasury Department acknowledges with appreciation the publication of this message by

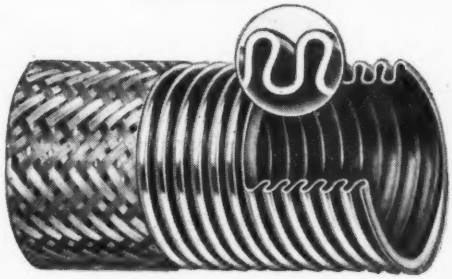
POWER

This is an official U. S. Treasury advertisement prepared under the auspices of the Treasury Department and the Advertising Council.

STOP

DANGEROUS AND WASTEFUL LEAKAGE OF TOXIC OR CORROSIVE SUBSTANCES . . .

WITH CMH REX-FLEX TYPE RF-51



REX-FLEX Type RF-51 — Made in standard sizes from 3/16" to 1½' I. D. with reinforcing metallic braid. Temperatures to 900° F. Working pressures to 900 psi., depending on size. Helical corrugations. Couplings are attached suitably for corresponding temperatures and pressures. Also available unbraided: Type RF-50.

the Stainless Steel FLEXIBLE METAL HOSE

Wherever complete dependability is required in conveying searching and corrosive liquids and gases at high or low temperatures, CMH Rex Flex is the answer. Scientifically formed by advanced methods from stainless steel strip, it withstands extreme cycles of vibration, flexation and variplane motions. Extremely versatile, it is used for a wide variety of services ranging from delicate weigh tank connections to heavy duty service in handling superheated steam. Ask for full details, today.

"FLEXON" identifies CMH products, which have served industry for more than 45 years.

"the science of **FLEXONICS** . . . "the controlled bending of thin metals for use under varying conditions of temperature, pressure, vibration and corrosion" . . . is exemplified in the basic products of Chicago Metal Hose Corporation.

CMH manufactures flexible metal hose for every industrial application. Catalog G-47 gives full details. Ask to see a copy.

CMH FLEXIBLE METAL HOSE

CHICAGO METAL HOSE CORPORATION

Maywood, Illinois

Plants at Maywood, Elgin and Rock Falls, Illinois

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Featuring additional products and specialties for power plants

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"MONO" BOILER BAFFLES HIGH TEMPERATURE Refractory Cements
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Power Plants — Industrial Plants
Steam and Electric Distribution Systems
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SANDERSON & PORTER
Engineers and Constructors
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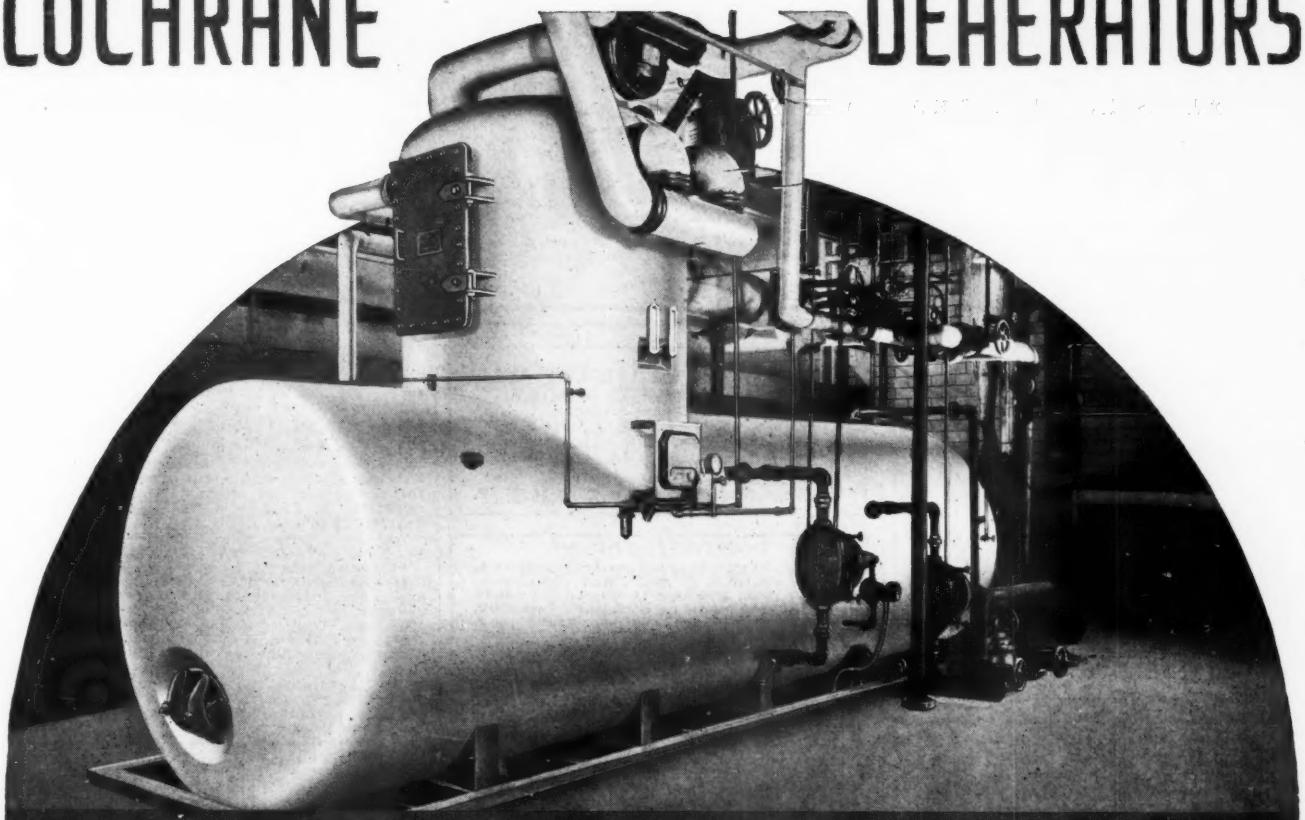
THE REAL VALUE

of placing your unusual problem in the hands of a competent consultant is that it eliminates the elements of chance and uncertainty from the problem and provides real facts upon which to base decisions.

COCHRANE DEAERATORS



Oxygen-free feed water at Brown Company's Cascade Steam Plant

IN steam plants of Brown Company's Mills at Berlin, N. H., Cochrane equipment is protecting modern boilers against corrosion, boiler carry-over, etc. Two Cochrane Deaerators are installed, one at the Cascade Paper Mill boiler plant and one at the new Kraft Pulp Mill recovery boiler installation, to remove excess oxygen from the feedwater. A Cochrane Continuous Blowoff System keeps boiler concentrations uniform and Cochrane Multiport Relief Valves, Cochrane Exhaust Heads and Cochrane Drainers assist in keeping the boiler plant operating at top efficiency. Literature on Deaerators, Continuous Blowoff Systems, Relief Valves, Drainers and Exhaust Heads may be obtained by addressing Cochrane Corporation, 3103 N. 17th St., Philadelphia 32, Pa.

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COCHRANE CORPORATION · PENNA · 85 YEARS OF SERVICE · 1863-1948

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(Classified Advertising)

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Positions Wanted (full or part time salaried employment only), ½ the above rates payable in advance.
Box Numbers—Care of publication New York, Chicago or San Francisco offices count as 1 line.
Discount of 10% if full payment is made in advance for 4 consecutive insertions.

Individual Spaces with border rules for prominent display of advertisements.

This advertising rate is $10.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞" vertically on one column, 3 columns—30 inches to a page.

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Power Plant
Superintendent
Public Utility

needs experienced man at once to take complete charge of new power plant of 40,000 KW capacity at 850 p.s.i. Location Eastern New York. Send full details of experience.

P-5206, Power
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CHIEF ENGINEER—POWER PLANT

Large Northern New England Utility has immediate opening for Chief Operating Engineer for 40,000 K.W. Generating Station now under construction. Technical graduate or equivalent with experience in operation at pressures in 600-800 range, age 35-40, preferred.

Early interview arranged for qualified applicant.

PUBLIC SERVICE COMPANY
OF NEW HAMPSHIRE
Masonic Building Dover, New Hampshire

WATER TREATMENT ENGINEERS AND CHEMISTS

Owing to expansion of the Engineering and Technical Sales Department, water chemists and engineers are required. A thorough knowledge of external and internal boiler feedwater treatment is the prime requisite. Locations available are West Coast, Texas area, Chicago and East Coast area.

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MECHANICAL ENGINEERS
WITH 5 TO 15 YEARS EXPERIENCE
In Steam or Gas Plant Design
Write To
MECHANICAL ENGINEER
Pennsylvania Power & Light Company
Allentown, Pa.

MECHANICAL DESIGN ENGINEER

Major Construction Division of Indiana Utility requires a Mechanical and Structural Designer for steam stations capable of approving drawings, specifications, contracts, and requisitioning equipment. State education and experience, salary desired, and availability.

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520 North Michigan Ave., Chicago 11, Ill.

Mechanical Design Engineer

With Administrative Experience in the Design of Steam Electric Stations
Preferably Between 35 and 45 Years of Age
LARGE EASTERN UTILITY
All Replies Strictly Confidential

P-3323, Power
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SHOP SUPERINTENDENT

For established electric motor rebuilding plant in Chicago employing 30 men. Must possess many years of varied experience on AC and DC motors, generators and control up to 500 H.P. Permanent, excellent working conditions in modern shop. Applicant must give full details of education, experience, executive ability and salary expected. Apply in confidence.

P-5735, Power
520 North Michigan Avenue, Chicago 11, Ill.

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (18)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

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ESTIMATOR AND Field Superintendents—Familiar with heating and plumbing work and outside sewer and water distribution systems. Advise experience, education and salary expected. P-5097, Power.

ASST. SUPT. — Mechanical — Steam-Electric Power Station. Must be experienced all phases mechanical operation and maintenance boilers, turbines, condensers, pumps, etc., accent on maintenance. Capable detailed supervision experienced workmen. Must be well grounded technically. Not necessarily a degree. Give full outline education, work and personal references, salary expected. All communications confidential. P-5171, Power.

GRADUATE MECHANICAL Engineer, thoroughly experienced in high pressure power plant piping for design and layout work; also, several designer draftsmen for interior plumbing and heating piping on large building projects. Location North Carolina. P-5252, Power.

DRAFTSMAN WANTED: Minimum one year experience in power boiler, tank, piping or structural steel work. These men needed for extensive expansion program. Positions will be permanent for qualified men. Springfield Boiler Co., Springfield, Ill.

SELLING OPPORTUNITY OFFERED

BOSTON SALES engineer handling industrial mechanical stokers desires adjunct line of power plant equipment for New England; sound combustion background and qualified to handle steam boilers or generators. SA-5733, Power.

WANTED MANUFACTURER'S REPRESENTATIVE

to contact coal-burning industrial institutions to distribute Today's Coal Bill Reducer (for high pressure boilers) which pays for itself quickly. Sales and combustion engineering experience desirable.
Address — P. O. Box 1367 — Chicago, Ill.

REPRESENTATIVES *WANTED*

To represent a progressive industrial and chemical Heat Exchange manufacturer in the following areas, Chicago, Cleveland, Buffalo, Syracuse, Boston, Philadelphia, Baltimore, Denver, Dallas and Seattle. Full sales cooperation from main office located in Newark, New Jersey area.

RW-5646, Power
330 West 42nd Street, New York 18, N. Y.

REPRESENTATIVES *WANTED*
FOR
COMPLETE LINE
OF
SHELL AND TUBE HEAT EXCHANGERS

- CHEMICAL
- INDUSTRIAL
- DOMESTIC

RW-5737, POWER
330 W. 42nd St., New York 18, N. Y.

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SALES ENGINEER. Power Chemicals Division of large chemical manufacturing organization has openings for representatives in all sections of the United States for sale of industrial water treatments—prefer men with experience or suitable chemical background. Salary, expenses and bonus arrangement. Send full particulars for interview. All replies confidential. E. F. Drew & Co., Inc., 15 East 26th St., New York 10, N. Y.

WANTED SALES and service engineer to contact industrial firms with a line of chemical maintenance products, including: Grease and Fuel Oil solvents and water treatments. Several well established territories available in Michigan, Ohio, Indiana, Illinois, West Virginia and Eastern Penna. Experience in steam power plant, equipment as well as chemical or engineering background helpful, but not absolutely essential. Excellent opportunity for man with top qualifications. State age, education, experience, salary expected, photograph and other data in your letter. SW 5625, Power.

MANUFACTURER'S AGENT selling packaged steam boilers in Minneapolis-St. Paul area wants additional lines. Address A. X. Nelson & Co., 1104 Baker Building, Minneapolis 2, Minnesota.

EMPLOYMENT SERVICES

SALARIED POSITIONS $3,500-$35,000. If you are considering a new connection communicate with the undersigned. We offer the original personal employment service (38 years recognized standing and reputation). The procedure, of highest ethical standards, is individualized to your personal requirements and develops overtures without initiative on your part. Your identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc., 270 Dun Bldg., Buffalo 2, N. Y.

SALARIED PERSONNEL, $3,000-$25,000. This confidential service established 1927, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. G, 241 Orange St., New Haven, Conn.

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POWER PLANT Engineer. Fully experienced in large industrial power plants. PW-5023, Power.

CHIEF OR SUPERVISING ENGINEER

Experienced all types boilers, generators, aux. power and domestic equipment, water and sewerage disposal systems, buildings and grounds maintenance, repair shop, engineering office and safety management, investigating, inspecting and reporting desires location East U.S.A. Most suited for well established large country hospital or institution, hotel, industrial plant or real estate company. Many excellent references, licenses & certificates. Age 40, married. PW-5729, Power—330 W 42 St NYC

TURBINES, GENERATOR FOR SALE!

1—2500 KW WHS. Condensing 3/60/600—3600.
1—500 KW Kerr Allis Condensing 3/60/600/2300—3600.
1—755 KVA Hor. Gen. 3/60/600—272 rpm.

WATSON & DESMOND
Used Machinery Department
Phone 36154 Charlotte, N. C. Box 1954

FOR SALE
SKINNER STEAM ENGINE

size 17x20 variable speed Universal unaflow heavy duty 230 h.p. at 225 r.p.m. new 1938. Excellent condition. Available due to plant liquidation may be inspected in Chicago.

FS-5736, Power
520 North Michigan Ave., Chicago 11, Ill.

This Seal JLHC ...tells you what you buy is GOOD EQUIPMENT!

GUARANTEED GOOD BECAUSE REBUILT AND TESTED UNDER SUPERVISION OF

HEMPHILL ELECTRICAL ENGINEERS

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3—300 KVA, Pitts., 2300 V. Pri., 115/230 V. Sec.
3—300 KVA, G.E., type H, 2300 V Pri., 115/230 V Sec.
300 KVA, Pitts., 7800-440 v.
305 KVA, Whse., 3 phase, 2300 to 3 ph., 4150 autp
300 KVA, Pitts., 4000 v.—110/220
4—150 KVA, G.E. KS 2300 V. pri., 115/230 V. sec.
100 KVA, Pitts., 1375/2750 v.—110/220
3—100 KVA, Wagners, 240/120 v.—120 v.
2—100 KVA, Newark, 440 v., 2 phase to 220 v., 3 phase
2—100 KVA, Whse., 13,800 v. to 250 v.
3— 75 KVA, G.E., 2400 v.—120/240
6— 50 KVA, Whse., 2400 v.—120/240
6— 50 KVA, Whse., 13,800 v. to 125 v. or 250 v.
6 —50 KVA, Whse., 6900 v. to 125 v. or 250 v.

A. C. GENERATORS

2500 KVA, Whse., Syn. Cond., 720 RPM, 2400 v.
500 KW, .8 P.F., 3600 RPM, ATB, 600 v.
320 KW, Allis, 450 RPM, 480 v.
240 KW, G.E., ATB, 600 RPM, 600 v.
200 KVA, Allis, 3600 RPM, 240 volt.
200 KVA, Whse., 600 RPM, 240 v.
180 KW, Whse., 514 RPM, 550 v.
165 KW, El. Mach., 514 RPM, 240 V.
100 KW, G.E. ATB, 600 RPM, 240 v.
75 KW, Whse., 900 RPM, 220 v.
62½ KW. Allis, 3600 RPM, 220 v.
7— 50 KVA, Whse., 900 RPM, 220 v.
3— 35 KWA, Columbia, 1200 RPM, 240 v.
1— 31.3 KVA, America, 1200 RPM, 120/208
15 KW Star, 1800 RPM, 220/440
12.5 KVA, Whse., 1200 RPM, 240 v.

TURBINE BLOWERS

1—Spencer Turbine Blower, 1000 cubic feet, 30 oz. preasure with a 15 H.P., 3600 RPM, General Electric Type FT, 200 volt motor.

1—Bellmore, 550 cubic feet, 7 inch vacuum, with a 20 H.P. 3600 RPM, General Electric, Type K, 220 volt 3 phase motor.

MOTORS, 3 Phase, 60 Cycle

SQUIRREL CAGE

750 H.P., General Electric, 750 RPM, 6600 v., 25 cycle
450 H.P., Ridgeway, 900 RPM, 2200 volts
125 H.P., G.E., KF, 1750 RPM, 2200 v.
125 H.P., U.S., 1200 RPM, Vert., 220 volts
150 H.P., G.E., KT, 1200 RPM, Vert., 220 volts
75 H.P., West., CS, 1750 RPM, 440 volts
60 H.P., Whse., 900 RPM, Vert., 2200 volts
60 H.P., Whse., 900 RPM, 440 volts
2— **40 H.P., G. E., 900 RPM, 220 volts**
35 H.P., Whse., 1200 RPM, CS, 2200 volts
35 G.E., 600 RPM, 550 volts
25 H.P., U.S., 1800/1200/900/600, 440 volt
2— **10 H.P., Whse., Gear 440 RPM, 440 volt**

MOTORS, 3 Phase, 60 Cycle

SLIP RING

1—**2500 H.P., G.E., Mt. 257 RPM, 6600 V.**
450 H.P., G.E., 425 RPM, ITC, 440 volts, 25 cycle
200 H.P., G.E., MT, 440 volt, BB, 720 RPM
100 H.P., G.E., IM, 440 volt, 25 cycle, 720 RPM
75 HP., Whse., CW, 720 RPM, 440 volt
75 H.P., G.E., MT, 1200 RPM, Vert.
50 H.P., G.E., MT, 600 RPM, 220 volt
1— **50 H.P., Whse., CW, 900 RPM, 220 volts**
40 H.P., Cont., 1200 RPM, JA85, 220 volt
40 H.P., G.E., 1200 RPM, MT, 220 volt
40 H.P., G.E., 900 RPM, 220 Volt, ITC
40 H.P., G.E., 900 RPM, MT, 900 RPM, 220 volt
40 H.P., G.E., 900 RPM, 2200 volt

LARGE STOCK OF

D.C. MOTORS AND GENERATORS

SYNCHRONOUS MOTORS

4—200/100 H.P., Whse., 720/360 RPM, 4150 V.
200 H.P., Whse., 600 RPM, 240v.
1—150 H.P., G.E., 1800 rpm, 220 V., TS
75 H.P., G.E., 1200 RPM, 440 v.
70 H.P., Elect. Mach., 180 RPM, 2200 v.
40 H.P., Whse., 1800 RPM, 220 v.
35 H.P., G.E., 1200 RPM, 2200 v.
20 H.P., Whse., 1800 RPM, 220 v.

MOTOR GEN. SETS

1—1000 KW G.E. 275 volts—4150—720 rpm. Syn.
1—1000 KW G.E. 600 volts—4150—720 rpm. Syn.
1—500 KW, G.E., 250 V. 900 RPM, 2300 V. Syn.
1—500 KW, G.E., 575 V. 900 RPM, 2300 V. Syn.
1—300 KW, G.E., 250 V. 1200 RPM, 2300 V. Slip Ring
1—200 KW, Whse., Rot. Con., 2300 V. A.C., 575V.D.C.
125 KW, CW, 125 v., 1200 RPM, 2300 v. sq. cage
100 KW, El Mach., 125 v., 1200 RPM, 4150 v., syn.
100 KW, G.E., 230 v., 900 RPM, 4150 v. syn.
2— 75 KW, G.E., 125 v., 1200 RPM, 220/440 v.
6— 75 KW, G.E., 60 v., 1200 RPM, 220/440 v.
50 KW, Ridgeway, 550 v., 1200 RPM, 220 v.
25 KW, G.E., AT1, 1800 RPM, 40 HP, 1800 RPM, 230 v.

PLATING M. G. SETS

250 amp., G.E., 5/6 volt, 220 v.
500 Amp., Hansen Van Winkle, 24 volt, 220/440 v.
2500 Amp., Chandeysson, 6/12 v., 400 RPM, Syn., 440 v.
3000 Amp., Chandeysson, 6/12, 400 RPM, syn., 440 v.

ENGINE GEN. SETS

150 KVA, G.E., Ames Uniflow, 220 v., 3 ph., non-cond.
2— 5 KW, Gasoline, Hobart, 1800 RPM, 120 v., 1 ph. cont. engines.
1— 200/275 H.P. Gasoline Engine, Van Blerck, 8 cylinder, 1500/900 rpm.

TURBO. GEN. SETS

625 KVA, Westinghouse, 2400 v., 3 phase, non-cond.
300 KW, G.E., ATB, 240 v., 3 ph., cond.
60 KW, Whse., 120 v., D.C., cond.
30 KW, Allis, 120 v., D.C., Terry non cond.

JLHC

THIS SEAL IS YOUR GUARANTEE

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1604 53rd STREET, NORTH BERGEN, N. J.

PHONE NEW YORK—LONGACRE 5-3227

PHONE NEW JERSEY—UNION 3-2600

POWER PLANT MACHINERY

AVAILABLE IMMEDIATE DELIVERY

TURBINE-GENERATOR UNITS

3 Phase, 60 Cycle

3125 KVA Westg. condensing 200 lbs. pressure, 600 volts, 3600 RPM complete exciter, surface condenser.

1875 KVA G.E. condensing 250 lbs. pressure, 2300 volts, 3600 RPM complete surface condenser.

1563 KVA Allis condensing 200 lbs. pressure, 600 volts, 3600 RPM complete exciter, condenser, switchboard.

1563 KVA G.E. condensing, 300 to 400 lbs. pressure, 2300 volts, 3600 RPM complete exciter, surface condenser.

1250 KVA Allis automatic extraction condensing 300 lbs., 25 lbs. bleeder pressure, 480 volts, 3600 RPM complete exciter, switchboard and condenser.

1250 KVA G.E. condensing, 250 lbs. pressure, 600 volts, 3600 RPM complete shaft exciter, switchboard and surface condenser.

1250 KVA G.E. condensing, 200 lbs. pressure, 4150 volts, 3600 RPM complete exciter, condenser, panel.

625 KVA G.E. condensing, 150-175 lbs. pressure, 480 volts, 3600 RPM complete exciter, switchboard, surface condenser.

625 KVA G.E. non-condensing 150 lbs. pressure, 15 lbs. back 2300 volts, 3600 RPM complete exciter, panel.

500 KVA Westg. non-condensing 150 to 250 lbs. pressure, 15 lbs. gauge, 240 v. complete exciter, switchboard instruments.

675 KVA (2) G.E. condensing 400 lbs. pressure, 450 volts, each complete exciter, switchboard, surface condenser.

375 KVA G.E. condensing 125 lbs. pressure, 2300 volts, 3600 RPM complete surface condenser and panel.

125 KVA Westg. non-condensing 175 to 200 lbs. pressure, 0-10, lbs. back, 240 volts with exciter, panel.

125 KVA G.E. non-condensing, 175 to 200 lbs. pressure, 10 lbs. gauge back, 2300 volts, 3600 RPM complete.

100 KVA Westg. non-condensing, 125 to 150 lbs. pressure, 10 lbs. gauge back, 2400/600 volts, 3600 RPM.

★

ENGINE-GENERATOR UNITS

ALTERNATING CURRENT—3 phase, 60 cycle

1125 KVA G.E. 480 volts, 150 RPM generator direct connected to 28" x 36" Skinner Unaflow engine.

750 KVA Westg. 440 volts, 164 RPM generator direct connected to 22" x 32" Nordberg Unaflow non-condensing engine, 150 to 200 lbs. pressure, 10 to 20 lbs. gauge back.

500 KVA Westg. 460 volts, 164 RPM generator direct connected to 26"x28" Skinner Unaflow non-condensing engine, 140 to 160 lbs. pressure, 0 to 10 lbs. gauge back.

500 KVA Crocker Wheeler, 440 or 2300 volts, 300 RPM generator direct connected to Skinner vertical Unaflow non-condensing engine, 150 lbs. pressure.

375 KVA G.E. 2300/440 volts, 200 RPM generator direct connected to 23" x 24" Skinner Unaflow non-condensing engine, 150 lbs. pressure.

375 KVA Fairbanks-Morse, 240 volts, 300 RPM generator direct connected to 450 HP, 300 RPM, 6 cylinder, Model 32-E-14 full Diesel engine complete with switchboard.

312 KVA G.E. 480 volts, 180 RPM generator direct connected to 24" 20" Skinner Universal Unaflow engine, 175 to 200 lbs. pressure.

ENGINE-GENERATOR UNITS

DIRECT CURRENT

400 KW (2) G.E. 250 volts, 360 RPM generator direct connected to Skinner vertical non-condensing engine, 150 lbs. pressure, 10 lbs. gauge back.

325 KW, 35°, 400 KW Maximum, Crocker Wheeler 125 volt, 300 RPM generator direct connected to Skinner Vertical Unaflow Engine.

250 KW Crocker-Wheeler, 250 volt, 257 RPM generator direct connected to 360 HP, 6 cylinder late type Fairbanks-Morse full Diesel engine—complete.

200 KW (3) New General Electric 120 volt Marine type turbine generator units.

125 KW G.E. 125 volts, 720 RPM generator direct connected 210 HP 6 cylinder Fairbanks-Morse Diesel engine.

100 KW (6) Delco 3-wire, 250 volt generator direct connected to 150 HP, 1200 RPM, 8 cylinder Superior Diesel engine complete with switchboard.

75 KW Allis Chalmers-Terry, 125 volts, 2400 RPM 150 lbs. pressure non-condensing turbine generator unit.

60 KW (3) new Westinghouse 120 volt Marine type turbine generator units.

15 KW Crocker-Wheeler, 125 volts, 410 RPM generator direct connected to an American Blower vertical engine.

★

MOTOR GENERATOR SETS

1500 KW Allis-Chalmers 550/600 volts, 300 RPM direct current generator direct connected 2190 HP, 3 phase, 60 cycle, 4000/6600 volts synchronous motor.

62½ KVA G.E. 3 phase, 60 cycle, 2300 volt, 1200 RPM alternator direct connected 75 HP, 3 phase, 60 cycle, 2300 volt motor.

50 KW Westg. 125 volt, 1200 RPM direct current generator direct connected 75 HP, 3 phase, 60 cycle, 2300 volt motor.

★

SPECIALS

900 HP (10) General Motors, Model 12-567 ATL, 12 cylinders, 744 RPM Diesel engines complete with auxiliaries. Practically new.

325 KW 35°C. rise, 125 volt, 300 RPM compound wound interpole direct current generator.

300 HP 80% P.F. G.E. type ATI, 2300 volts, 720 RPM synchronous motor.

900 HP (2) Allis 3 phase, 60 cycle, 220 volts, 150 RPM synchronous motors.

500 KVA Westg. 3 phase, 60 cycle, 440/550 or 2300 volts, 514 RPM three bearing belted alternator.

200 KVA Westg. 3 phase, 60 cycle, 2300 volt, 257 RPM engine type alternating current generator with direct connected shaft exciter and switchboard.

300 KVA G.E. type ATI, 2300/440 volts, 720 RPM generator.

5425 GPM Worthington 70' head, 1800 RPM centrifugal pump direct connected to 125 HP G.E. 3 phase, 60 cycle, 2200 volt slip ring motor.

1—Allis-Chalmers jet condenser suitable for 2000 KW steam turbine-generator unit.

4400 sq. ft. two-pass. Worthington surface condenser.

1250 sq. ft. Elliott surface condenser.

10 ton Capacity Brown hand operated traveling crane with 31' 10" span including 150' of I-beams.

Utilities Electrical Machinery Corporation
600 NATIONAL CITY BANK BLDG.
CLEVELAND 14, OHIO
WIRE OR PHONE
LONG DISTANCE 422

HERE'S WHY WE CAN SAY "Successful Operation GUARANTEED"

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IT'S ALL BELYEA

TRADE RE-NU-BILT BELYEA MOTORS MARK

RE-NU-BILT EQUIPMENT

REBUILT IN ACCORDANCE WITH N.I.S.A. STANDARDS

SPECIAL

2—3 Unit—200 KW—Syn M-G Set—440 V., 3 ph. 60 cy., Motor with 2—100 KW., 250 V. Gen.—Also 4—125 HP, 1750 RPM, 250 V. D.C. Motors—Reduced Voltage, A.C. Starter and Amplidyne Control for D.C. Motors. Also Exciter M-G.

MOTOR GENERATOR SETS

3 ph. 60 cycle

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
1	1500	G.E.	600	600	2300/4150
1	1500	G.E.	360	275	2200/4400
1	1000	G.E.	720	600	4000
1	1000	West.	514	250	4150
1	1000	Al. Ch.	720	450	2300
2	500	G.E.	720	600	2300/4150
1	500	G.E.	720	600	6600/13200
1	500	G.E.	720	600	4400
1	500	G.E.	720	125	6600/13200
1	400	Whse.	1200	250	440/2300
1	350	G.E.	900	125	50
1	300	G.E.	720	550	2300/4000
1	250	G.E.	720	275	2300/4000
1	250	G.E.	1200	250	440
1	150	Cr. Wh.	1200	250	440
1	100	G.E.	1170	125	220
2	90	G.E.	1800	60	220/440
1	75	Cr. Wh.	1160	250	220/440
1	75	G.E.	1180	125	2300/4000
1	60	Cr. Wh.	1750	250	220/440
1	60	Whse.	1150	60	220/440
1	50	G.E.	1145	125	220
2	50	G.E.	1200	250	2200
1	50	G.E.	1145	125	220
1	48 (30)	G.E.	1750	60	440
1	45	G.E.	1200	60	220
2	35	G.E.	1200	120	440
1	25	Whse.	1750	125	2300

FREQUENCY CHANGER SETS

1—1000 KW—GE—2 Unit—3 Brg. Consisting of—1400 HP—4400 V, 3 ph. 25 Cy. Motor and 1000 KW—2300 V.—8 ph. 58.3 cycle gen. with exciter (Gen can be reconnected for 800 KW 3 ph.)

1—320 KW—GE—2 Unit—3 Brg. consisting of 600 HP—440 V., 3 ph. 60 cy., 8 pf. Syn. Motor and 400 KVA .8 pf. type AT—3 ph. 120 cy. 720 volt AC generator with direct connected exciter.

SYNCHRONOUS CONDENSERS

Qu.	Kva.	Make	Type	Volts	Speed
1	5140	Whse.		4150	600
1	4000	G.E.	TSC	2400/4800	900
1	500	G.E.	ATI	480	900

D.C. MOTORS

HP	Make	Type	Volts	Speed
6—1500	Whse.		525	600
1—1200	Whse.		600	425
1—800/1000	Whse.		450	600/720
1—765	G.E.	MPC	500	1045/1350
1—700	G.E.	MCF	600	150/525
1—650	G.E.	MPC	250	115/145
1—300/400	G.E.	DYNA	250	1325/2500
1—375	G.E.	MPC	230	450/900
1—335	Whse.	MQ	250	300/900
1—250	G.E.	MPC	230	400/500
1—230	Al. Ch.		230	700
1—80/180	G.E.	MPC	240	400/1000
1—150	G.E.	MPC	230	250/450
1—150	Cr. Wh.	CCM	230	300 1050
10—150	Cr. Wh.	83H	230	890
1—150	Cr. Wh.	CMC-65H	230	1150
2—125	G.E.	CO-1832	230	625
1—125	El. Dy.	30S	230	750/1500
1—115	Cr. Wh.	JHL	230	1200
4—101	Whse.	SK	230	485/950
1—100	Whse.	SK-182	230	300/1200
1—50/100	G.E.	CD-175	230	365/730
1—80	El. Dy.	30S	230	500/1500
1—80	Whse.	SK-180	230	450/1200
2— 75	El. Dy.	25-SL	230	750/1750
3— 60/75	Whse.	SK-200	115	300/700
8— 75	Cr. Wh.	53-H	230	860
1— 75	Cr. Wh.	CMC	230	1150/1760
1— 60	El. Dy.	25-S	230	525/1050
2— 60	Whse.	Hoist.	230	415
1— 60	Whse.	SK	230	500/1000
1— 60	Whse.	SK-131	230	500/1500
1— 60	El. Dy.	25S	230	750/1500
2— 50	G.E.	RCP-31B	230	1700
1— 50	G.E.	RC-34	230	1050
1— 50	G.E.	RF-16	230	500/1500
1— 50	Whse.	SK-131	230	500/1500
4— 50	Whse.	Hoist	230	400
1— 50	Whse.	SK-153	230	690/1035
1— 50	G.E.	CD-123	230	675/1035
1— 50	Whse.	SK-170	230	350/1050
1— 50	Cr. Wh.	CMC-8014	230	380/750
1— 50	Rel.	461-T	230	250/1000
3— 40	Rel.	385-T	230	400/500

These units are semi-enclosed, b. brg. motors and part of complete V-S Drive with 40 KW Ind. M.G. Set with 220/440 v. A. C. Motor; exciter and complete control equipment. M. G. and control in steel enclosure.

ROTARY CONVERTERS

60 Cycle

KW	Make	Speed	D.C. Volts	A.C. Volts
1—1500	Whse.	720	600	2300
1—1000	G.E.	900	600	11000
1—1000	Whse.	900	600	11000
1— 750	Whse.	900	600	13200
1— 750	Whse.	720	250	6600
1— 500	G.E.	900	250	2300

SPECIAL—MERCURY ARC RECTIFIERS

1—750 KW—GE—Type RHW—6 Anode 575 V., D.C. Form C with 2300 V., 60 cycle transformer and switching equipment.

1—500 KW—GE—Type RHW—6 Anode 575 V., D. C. Form 8 with 2300 V., 60 cycle transformer and switching equipment.

A.C. MOTORS

3 ph. 60 cycle

SYNCHRONOUS

HP	Make	Type	Volts	Speed
2—3500	G.E.	TS	2300	257
1—2100	G.E.	ATI	4600	510
2—2000	Whse.		2300	120
1—1000	Whse.		2300	189½
1— 900	Al. Ch.	(New)	2200	150
1— 500	G.E.	ATI	480	900
2— 500	G.E.	TS	4150	600
1— 450	Whse.		2300	128.5
2— 450	Whse.		2300	1800
2— 350	G.E.	TS	2200	150
1— 320	G.E.	ATI	2300	600
1— 300	G.E.	ATI	440	720
1— 150	G.E.	TS-7558	2200	720
1— 145	G.E.	ATI	550	720
1— 100	Whse.		550	600
1— 85	G.E.	TS	440	1800

SLIP RING

1—1000	Whse.	CW	2300	700
1— 900	G.E.	IM	2300	880
2— 500	G.E.	IP	550	505
1— 400	G.E.	IM	2200	252
1— 350	G.E.	MT-442Y	2200/4000	253
1— 300	Whse.	CW	440	1750
2— 300	Al. Ch.	3 Brg.	2300	505
1— 250	G.E.	MT-563Y	550	900
1— 250	G.E.	MT-424Y	4000	257
1— 250	G.E.	MT-559S	2200	1800
1— 135	G.E.	IM	2300	700
2— 100	G.E.	IM-16	2200	435
1— 75	Whse.	CW-761	2300	1750
1— 75	F.M.	By-H16B	2300	1750
3— 50	Whse.	CI-638A	220	870
2— 50	Whse.	CIW-504	440	870
1— 50	Rel.	1XM	2300	880
1— 50	G.E.	MT-352	550	600

SQUIRREL CAGE

1— 250	G.E.	1K	440	600
1— 250	G.E.	KT-559	440	1800
1— 200	(New) G.E.	K	2300	1200
1— 200	G.E.	1K	550	865
1— 125	(New) G.E.	KF-TEFC	440	1190
1— 100	G.E.	1K-Vert.	2300	450
1— 75	G.E.	K	2200	1200
1—60/20	Whse.	CS	220	900/450
1— 50	G.E.	KF-405S	220/440	3550
2— 50	Whse.	CS	220	870
1— 50	G.E.	KT-327	2200	1750

Turbo Generators

See our advertisement on page 267

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GLOW

SQUIRREL CAGE MOTORS

HP	RPM	Volts	Make
750	900	6600	Wtg.-CS
350	514	440	GE-I
250	600	2300	Triumph
200	490	2200	GE
150	600	2200	GE
125	340	220	A-C
100	514	220	A-C
85	3600	2200	GE
75	900	2300	GE
75	720	2300	Wagner
75	360	220	GE-I
60	3600	2300	GE-KT
60	900	440	GE-KT
50	3600	440	R. & M.
50	900	220	GE
50	720	2300	Wtg.-CS
40	900	2300	Wtg.-CS
40	720	440	GE-KT
35	600	220	FT. Wayne
30	1800	dual	Delco
30	1200	dual	Master
30	720	220	GE-H1
30	514	440	Stanley
25	3600	dual	L-A
25	1800	dual	GE
25	1200	220	Wesche
25	900	440	GE
25	900	220	GE-FTR
25	720	220	Wagner
25	600	440	GE-I
20	3600	dual	GE
20*	1800	220/440	Master
20*	1800	220/440	Wesche
20	1200	440	Al. Ch.
20	900	440	Wtg.-CCL
20	600	220	GE
15	3600	220	GE-KT
15	1800	220	W-E
15*	1800	220/440	Master
15	1200	220	Ridgeway
15	900	220	Al. Ch.
15	600	220	Burke

ENCLOSED SQUIRREL CAGE

HP	RPM	Volts	Make
40	1200	220	Westgh.
30	1800	dual	Delco
30	1200	440	Wagner
20	1200	440	Wagner
15	1800	dual	Delco
15	1200	220/440	Delco-TEFC-BB
7½*	1800	dual	Wagner-TEFC-BB
7½*	1800	dual	Master-TEFC-BB
7½	1200	dual	GE-HI Slip-TEFC-BB
7½	1200	dual	Delco
7½	1090	220/440	GE-KR, high slip
5*	1800	dual	Master-TEFC-BB
5	1800	220	Wagner TE-BB
5*	1200	dual	GE-TEFC-BB
3	3600	440	Wtg.-TE-BB
3	1800	dual	Delco-TEFC-BB
3	1200	dual	Rel-TEFC-BB
3	900	dual	Delco
2	1800	dual	Delco-TEFC-BB
2	1200	220	GE-TE-BB

*New Motor

ENCLOSED SQUIRREL CAGE—Cont'd.

HP	RPM	Volts	Make
2	900	220	Wagner-TE-BB
1½	900	dual	Delco-TEFC-BB
1½	1800	dual	L. Al.-TE-BB
1½	1200	dual	Rel-TE-BB
1	3600	220	Haskins-TEFC
1	1800	dual	Master-TEFC-BB
1*	1800	dual	Delco-TE-BB
1*	1200	dual	Rel-TE-BB
¾	3600	4400	Delco-TE
¾	1800	dual	Wesche-TE-BB
½	3600	220	Ohio-TE-BB
½	1800	440	Wtg.-TE-BB
½	1800	440	Delco-TE-BB
½	1800	dual	Delco-TE-BB
½	1200	220	Cr. Wh.-TE
½	900	dual	Delco
½	3600	dual	Delco
½	1800	dual	Delco
¾	3600	440	GE-TE
¾	1800	220	Delco-TE-BB
¼	1800	440	Delco-TE
¼	1200	220	GE
¼	600	220	Jeannin

SLIP RING MOTORS

HP	RPM	Volts	Make
500	900	440	GE-3 Brg.
400	1200	2300	Al. Ch.
375	1800	2300	Al. Ch.
235	1800	220	GE-I
250	300	2300	Al. Ch.
60	1800	dual	Al. Ch.
60	900	2300	Burke
60	900	220	Wesche
50	900	2300	Ridgeway
50	900	440	Wagner
50	720	440	Al. Ch.
40	1200	220	GF-MT-336
40	900	220	Wtg.-HF
40	720	2300	Wtg.-HF
40	720	220	Al. Ch.-ARY
40*	600	2300	Al. Ch.ARY
40	600	220	Al. Ch-ARY
40	450	220	Triumph-C
35	1200	220	Westgh.
35	900	220	Al. Ch.
35	900	2300	Ridgeway
35	720	220	GE-I
30	1800	2300	Wtg.-CW
30	1200	440	Wagner
30	1200	2300	Lincoln
30	900	220	GE-MT
30	900	2300	Ridgeway
30	720	220	GE-I
30	600	220	F. Morse-BV
25	1200	2300	Al. Ch-ANY
25	1200	220/440	Watson-KH
25	900	220	GE-MT
25	600	220	Watson
20	600	440	Westgh.
20	900	2300	GE-I

VERTICAL MOTORS

HP	RPM	Volts	Make
200	1200	440	Al. Ch.-SR
150	1200	2200	GE-I
150	1200	440	GE-Cage

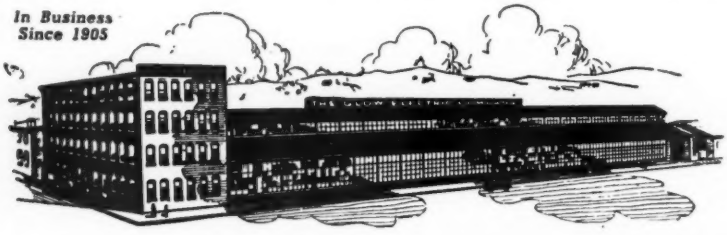
VERTICAL MOTORS—Cont'd.

HP	RPM	Volts	Make
125	1200	2300	Al. Ch.-Cage
100	1200	440	GE-Cage
75	1200	2200	GE-Cage
75	360	220	Ideal-Cage
60	1800	230 D.C.	GE
60*	1200	440	Al. Ch.-Cage
50	1800	440	GE-Cage
50	1200	2200	Wtg.-Cage
50	600	440	Al. Ch.-Cage
40	1800	220	GE-Cage
40	1700	230 D.C.	GE
40	1200	440	Wtg.-SR
40	1200	220	GE-Cage
40	1200	440	GE-Cage
35	1800	440	GE-Cage
35	1200	2300	Al. Ch.-Cage
35	450	440	GE-Cage
30	1200	dual	Wtg.-Cage
25*	1550	230 D.C.	GE
25	1200	2200	GE-Cage
25	850	230 D.C.	Wtg.
20*	1800	440	Al. Ch.
20*	1200	440	Al. Ch.-Cage
15*	1800	440	Al. Ch.-Cage
15	1750	110 D.C.	Wtg.
15	1150	230 D.C.	GE
15	600	440	Al.-Ch.
12½	900	220	L. Al.-Cage
10	3400	230 D.C.	Wtg.
7½	1800	500 D.C.	Peerless
7½	900	440	Burke
7½	700	230 D.C.	GE
6	850	110 D.C.	Rel.
5	1400	230 D.C.	R. & M.
5	600	440	GE-Cage
4	1650	110 D.C.	Watson
3	1700	230 D.C.	Watson
3	1200	dual	Wtg.-Cage

SYNCHRONOUS MOTORS

HP	RPM	Volts	Make
1015	500	2200	Wtg.-25 cycle
700	500	11000	GE-25 cycle
600	750	440	GE-25 cycle
500	600	4160	GE
350	750	4000	GE-25 cycle
250	225	2200	GE
250	225	440	GE
200	600	2300	GE
200	225	2200	Wtg
160	600	440	GE-ATI
115	164	208	GE
60	360	2200	GE
50	360	440	GE
30	900	440	Wagner
30	600	550	GE
30	450	dua	Wtg.
30	360	550	GE
30	327	220	E-M
25	1800	220	Wagner
25	450	220	E-M
25	300	220	Ideal
20	900	220	Wtg
20	600	220	E-M
15	1800	220	Wagner
10	1800	220	Wagner
10	1200	220	Wagner
7½	1200	440	Wagner

In Business Since 1905



ELECTRIC CO

D. C. MOTORS

115 Volts

HP	RPM	Description
225	750	GE-MPC,
60	1200	Star
35	975	Northern
35	610	GE
40	200/600	Sprague
25	1150	Triumph
25	750	GE
20	700	Triumph
20	800/1500	GE-RF11
20	400/1200	GE-RLC fr. 202A
15	1200	J. & L.
15	1100	Westgh. SK80L
15	1000	GE-CE
15	975	F-M
15*	975	Westgh.-8 fr. 6
12	825	Northern
10*	950	Barriet, type E
10	825	C-W-CCM
10	750	R & M type I-10
10	700	J. & L.
10	650	J. & L. type C1
8	1500	Elect. Dynamic (series)
7½	3500	GE, type B
7½	1950	F-M, type CP
7½	1150	F-M, type CP
7½	975	Westgh.-S-3
7½	750	J. & L. type C1
7½	700	J. & L. type C1
7	800/1500	Reliance-T-66T
7½	500	Westgh.-SK-BB
7½	170/220	Diehl-NG90
5	3600	Star-SF3-BB
5	1800	Wesche-BB
5	950	Swing-E-6
5	650/1950	Imperial-HVI
5	535/1070	C-W, type CMC

DC MOTORS—Cont'd.

5	400/1600	Northern-8
5	260	Diehl-BH
2½	575	GE-1iC
2½	300/1200	Reliance-34T
2*	3500	American, type 1-BB
2	1200	Westgh-SK
2	1000	Triumph
2	900	Watson-AW4B
2	500/2000	GE-CD
1½*	1750	Marathon
1½	600/1800	Watson-BW
1½	500/1500	GE-RA
1	1725	B-B, type DM
1	1150	GE-RC
1	920	Peerless
1	700	F-M, type TR
1	780/1560	C-W, type CM
1	600	Northern

*New Motor

D. C. GENERATORS

125 Volts

KW	RPM	Description
500	750	GE-MCF
300	1500	GE-CC
100	1000	Wh.-DLC
100	900	C-W-CCD
80	500	J. & L.-G
80	400	J. & L.-G
65	1100	W-E, type ELC-7
60	1200	Star, type SQ, single bearing
55	1000	GE-Type TD
35	1165	GE-DLC
31.25	1400	Westgh.-SK-single bearing
30	1200	Al. Ch., single bearing
25	1200	Westgh.-SK, single bearing

D. C. GENERATORS—Cont'd.

25	1100	GE-C1.
25	600	*Westgh.-SK, frame 150
25	300	W-E, type B
16.5	1200	Westgh. BB-DS-1
15	3600	GE-BF
15	1100	Al. Ch.
10*	1750	Westgh.-SK-43
9	1100	R. & M.
9	400	F-M
7½	3600	GE-BR
4	750	Westgh.-SK50L
2	1400	Westgh.
2	1200	Westgh.-SK

D. C. GENERATORS

230 Volts

KW	RPM	Description
400	1200	Westgh.
200	375	J. & L.-type K
175	450	Westgh.
125	1400	Westgh.-SK-130L
100	1500	Westgh.-SK-170
80	1050	W-E
60	1200	Ideal-DV
35	1800	GE-RC
35	970	GE-DLC
30	1200	Westgh.-SK, single bearing
30	300	Triumph
22½	765	Westgh.-SK
21	890	C & C, type SL
18	300	Burke
15	1800	L-A
15	350	Westgh.-SK
15	250	GE-CD
5	850	Triumph
1½	900	J. & L.-A1-7
1.2	1750	C-W-CCD

AC & DC MOTORS • GENERATORS • PUMPS
SYNCHRONOUS MOTORS • CONTROL EQUIPMENT
MOTOR GENERATOR SETS • ELECTRIC EQUIPMENT
STEAM ENGINE GEN. SETS • SLIP RING MOTORS

927 HARRIET ST.
PHONE MA. 3024
CINCINNATI 3, OHIO

POWER PLANT MACHINERY

60,000# steam per Hour Foster Wheeler Boiler

PACKAGE TYPE BOILERS

60,000# steam per hour Foster Wheeler steel — encased boilers, modified "D" type, two drum, bent tube, 435# pressure, 750 deg. total temperature.

Boilers equipped with waterwalls, superheaters, economizers, Vulcan soot blowers, Swartwout feedwater regulators and Todd oil burners.

The above boilers can be shipped intact on underslung railroad flat cars. They were built new for the Government in 1943 and are in excellent condition. They are still connected up as in operation and are equipped with interconnecting piping, valves and fittings.

CONDENSING TURBO UNITS

3 phase 60 cycle

2250 KVA G.E. 3 phase 60 cycle 480/600/2300/4150 volts, 3600 RPM 10-stage, 250/400# steam pressure, 725 deg. TT. Equipped with air cooler, surface condenser and auxiliaries. New 1943.

3125 KVA Westg. 600 v., 250# steam.
1875 KVA G. E. 600 v., 235# steam.
1563 KVA G. E. 2300 v., 250# steam.
1250 KVA Westg. 2300 v., 400# steam.
1250 KVA G. E. 4150 v., 200# steam.
625 KVA G E. 2300 v., 200# steam.

NONCONDENSING TURBO UNITS

3 phase 60 cycle

625 KVA Westg. 480 volts, 225# steam, 10# exhaust.
625 KVA G. E. 2300 volts, 150# steam, 20# exhaust.
375 KVA G. E. 240 volts, 150# steam, 10# exhaust.
187 KVA G. E. 440 volts, 250# steam, 15# exhaust.

EXTRACTION TURBO UNITS

3 phase 60 cycle

1250 KVA Allis, 480 volts, 300# steam, 35# extraction.
937 KVA Wstgh., 480 volts, 150# steam, 10# extraction.
750 KVA G. E., 480 volts, 200# steam, 15# extraction.

UNIFLOW UNITS

3 phase 60 cycle

1000 KVA Skinner, 480 volts, 160# steam, 7# exhaust.
750 KVA Skinner, (vertical) 480 volts, 150# steam, 5# exhaust.
625 KVA Skinner, 2300 volts, 150# steam, 5# exhaust.
500 KVA Skinner, 450 volts, 160# steam, 5# exhaust.
375 KVA Skinner, 2300 volts, 150# steam, 5# exhaust.
312 KVA Skinner, 480 volts, 140# steam, 5# exhaust.
250 KVA Skinner, 480 volts, 140# steam, 5# exhaust.

LIGHTING TRANSFORMERS

18-25 KVA Westinghouse, type AVR, single phase, 60 cycle, 480 volts, primary, 120 volts secondary. New 1942.

DIESEL UNITS

3 phase 60 cycle

1250 KVA Fairbanks Morse, 4160/2400-/480 volts.
1150 KVA Superior, 2300 volts.
875 KVA DeLaVergne, 2300 volts.
470 KVA Nordberg, 2300 volts.
375 KVA (3) Ingersoll Rand, 480 volts.

MOTOR GENERATOR SETS

3 phase 60 cycle

1800 KW G. E. 125/250 volts, D.C., 4000 volts, A.C.
1000 KW G. E. 250 volts, D.C., 4600 volts, A.C.
500 KW G. E. 250 volts, D.C., 440 volts, A. C.
300 KW Allis, 250 volts, D.C., 2300 volts, A.C.

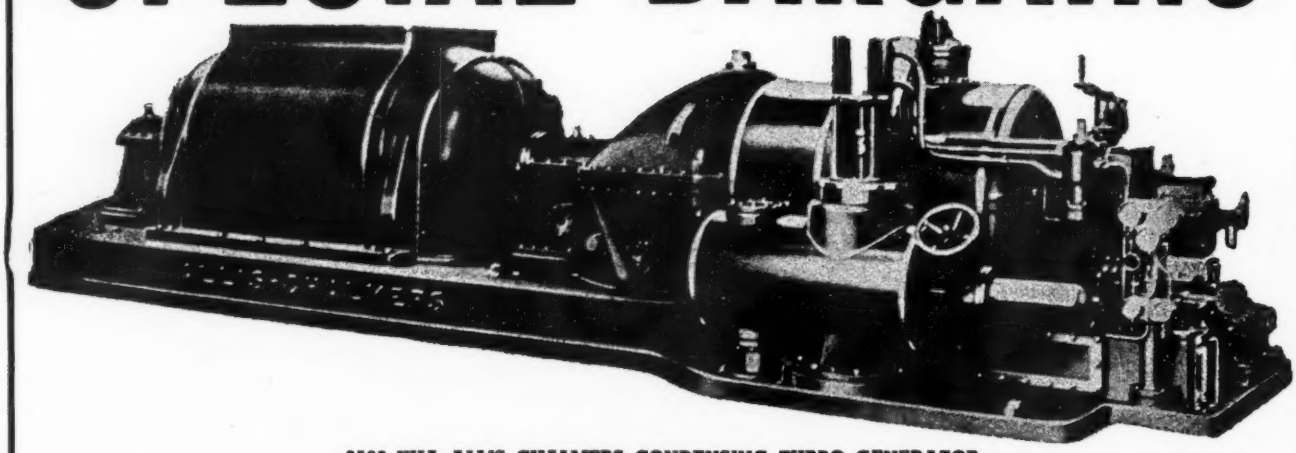
SYNCHRONOUS MOTORS

6—3500 HP G.E. totally enclosed synchronous motors, 3 phase, 60 cycle, 4000/2300/550/-440 volts, 257 RPM. Equipped surface air coolers and couplings. New 1943.

INTERNATIONAL POWER MACHINERY CO.

UNION COMMERCE BLDG. Telephone: MAin 9514 CLEVELAND 14, OHIO

SPECIAL BARGAINS



2500 KVA ALLIS CHALMERS CONDENSING TURBO GENERATOR

2 Specials

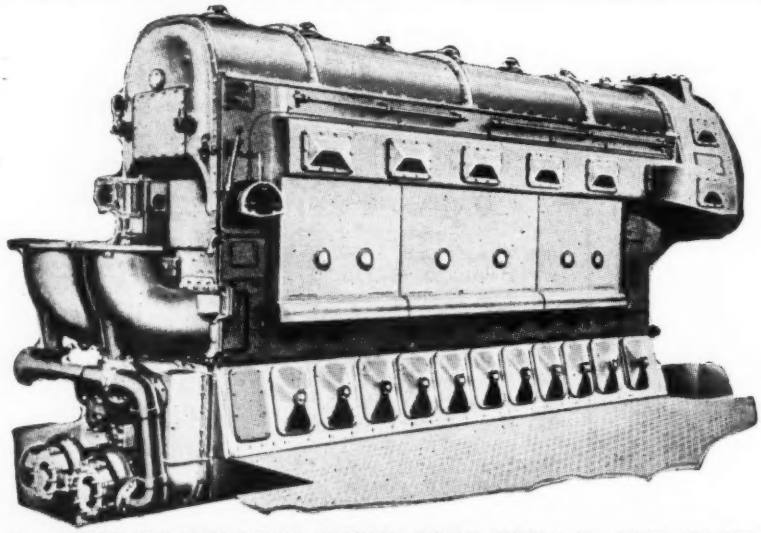
1—2000-KW., 80%-PF., 2500-KVA; NEW BLADING; NEW WINDINGS
1500-KW., 80%-PF., 1875-KVA.; NEW BLADING; NEW WINDINGS
New Condensers, Surface Type; New Auxiliaries
COMPLETE INSTALLATIONS; IMMEDIATE DELIVERY

OUR STOCK IS ONE OF THE LARGEST IN THE WORLD OF GOOD, USED AND NEW POWER PLANT EQUIPMENT

Send Us Your Specifications, Capacity, Voltage Steam-PSI

AUGUST SPECIALS

NEW 5000-KVA., G.E., 600#-psi, 750-FTT
Immediate Delivery
Aut. Extr. at 150#: Non-Cond. @ 25#
NEW—On Original Skids. Wire or Phone.
Also: 2—3750-KVA., G.E., New Surf. Condensers: 2—1875 KVA. West. Surf. C.
NEW, NEVER INSTALLED, G.E., 1075-KVA. Geared, 525#-psi. Delvy. Immediate
New 1075-KVA., G.E., 450#psi.-Immediate Delivery



8—FAIRBANKS-MORSE DIESEL ENGINES, MODEL 38D8-1/8; SAME AS NEW
NEW GENERATORS: IMMEDIATE DELIVERY: COMPLETE UNITS:
4—400-HP. ENTERPRISE DIESEL ENGINES, NEW, NEVER UNBOXED; READY FOR EXPORT

Send Us Your Specifications: Anything Wanted in Diesels?

ALWAYS GET WEAVER CO.'S PRICES BEFORE BUYING: 25 TO 50% SAVING ON ALL NEW ITEMS
Your Cooperation Invited & Appreciated

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CHARLES WEAVER & COMPANY

Electrical - Mechanical Engineers
4045 Penobscot Building Detroit 26, Michigan

Telephones:
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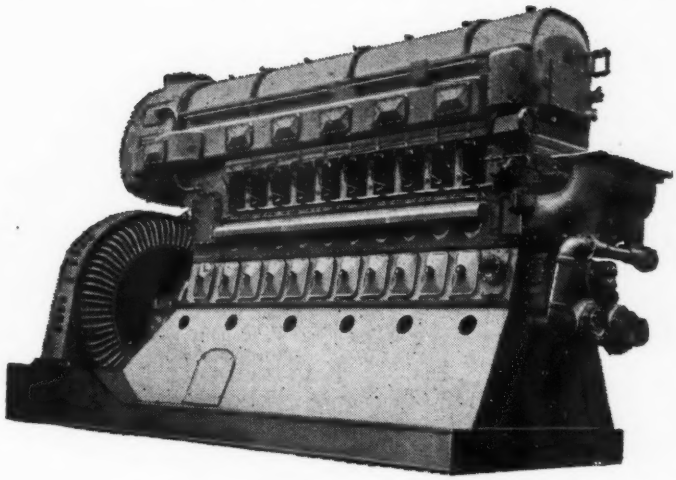
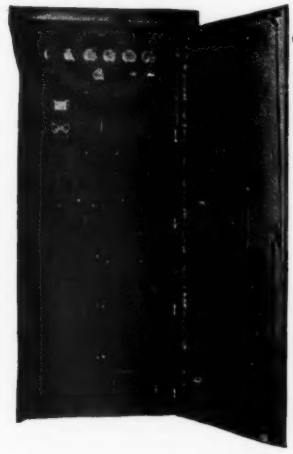
ENGINEERED AGSCO DIESEL POWER

COMPLETE PLANTS IMMEDIATE DELIVERY





1250 KVA FAIRBANKS MORSE DIESEL GENERATING SET, MODEL 38D8⅛ WITH *NEW* ELECTRIC MACHINERY MANUFACTURING CO. ALTERNATOR, 3 PHASE, 60 CYCLE, 2300 VOLTS.

Unit is offered complete with switchboard and all auxiliaries and accessories.

OTHER OFFERINGS READY FOR PROMPT SHIPMENT

50 AND 60 CYCLE DIESEL GENERATING UNITS

KVA	Make	HP	Model	RPM
*1250	General Motors	1600	16-278A	720
*1250	Fairbanks Morse	1600	38D8⅛	720
1250	Nelseco	1500	6M1-53	300
1000	Fairbanks Morse	1200	38D8⅛	600
*900	General Motors	1200	12-567	720
750	General Motors	900	12-567	600
*625	General Motors	750	8-278A	720
400	Ingersoll Rand	460	S	600
375	Baldwin	448	VO-6	400
375	Worthington	450	DH-6	450
375	General Motors	450	8-268A	1200
312	Cooper Bessemer	375	FSN-6	900
312	General Motors	450	8-268A	1200
300	Fairbanks Morse	360	Y	257
250	General Motors	350	8-268A	1200
156	Fairbanks Morse	150	32E14	300
125	Murphy	150	ME-650	1200
125	General Motors	150	3-268A	1200
100	Buckeye	150	E	325
94	General Motors	160	6045A	1800
62	International Harvester	76	UD-18	1200
42	Fairbanks Morse	110	32D	360
25	Lister	30	2 7/3	1200

*** THESE UNITS ARE AVAILABLE AS PORTABLE SETS**

Write for Bulletins

DIESEL ENGINES

AG **SCHOONMAKER CO INC.**

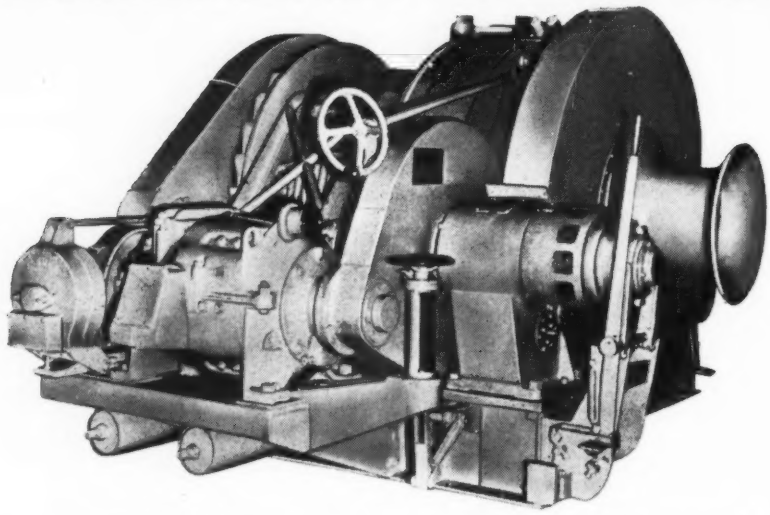
Business Est. 1898

DIESEL POWER

50 CHURCH STREET NEW YORK 7, NEW YORK

Cable Address: AGSCOMACH PHONE: Digby 9-4350

LIQUIDATION SALE—Modern Equipment



Winch, up to 100,000# pull, variable speed, heavy duty (see "Hoists")

MOTORS

3 Ph. 60 Cy.
6—3800 HP 1700 V 257 RPM G.E.
5— 700 HP 2300 V 128 RPM

D.C.
1500 HP 525 V DC 600 RPM W'hse
667 HP 374 V DC 1300 RPM Elliott
444 HP 250 V DC 930 RPM Elliott
222 HP 230 V DC 3050 RPM W'hse

GENERATORS

1200 KW 525 V DC 750 RPM All. Chalm.
1075 KW 375 V DC 750 RPM Elliott
700 KW 240 V DC 500/720 Elliott
540 KW 240 V DC 1200 RPM West.
100 KW 120/240 1200 RPM Delco
2250 KW 1700 V AC 257 RPM G.E.

TURBO-GENERATORS—A.C.

6—300 KW G.E. type ATI 3/60/450, 1200 RPM cond., compl., with 40 KW exciters., condensers, switchboards.
2—250 KW G.E. type ATI 3/60/450, 1200 RPM, cond.
2—200 KW Westinghouse, 3/60/450, 1200 RPM cond. (NEW).
8—200 KW, G.E. type ATB 3/60/450, 1200 RPM cond. and non-cond.
2—132 KW G.E. type ATB 3/60/450, 1200 RPM, cond.

TURBO-GENERATORS—D.C.

KW	Volts	Winding	Speed	Type
2—375	180/240	Shunt	1200	non-cond.
1—300	120/240		1200	
2—250			1200	
12—150	120	Shunt	1200	cond.
20— 60	120	Stab. Sh.	1800	cond.
3— 25	120	Stab. Sh.	1200	cond.

BOILERS

10—Cleaver-Brooks, 2000# steam pr. hr. 35# press.
6—Cyclotherm 3000 pounds steam per hour, 125# press.
6—Express Boilers, modified D type, Foster Wheeler 30,000# steam/hr., 435# press., with economizers, superheaters, desuperheaters, oil burners, etc.
8—B&W, D type, 580# press., 5400 sq. ft. heating surface.

DISTILLING PLANTS

2—40,000 gallons per day, Foster Wheeler triple effect low pressure.
1—80 tons per day. Condenser Service, double effect.
10—2000 gals. per day Kleinschmidt vapor compression distiller mfd. by Badger.
1—750 gals. per day, same as above.

HYDRAULIC PUMPS

5—Vertical, quintuplex, 4⅝ x 10, 450 gpm at 128 RPM against 2500 p.s.i., mfd. by Aldrich driven by 700 HP synchr. motors 3/60/2300.

CONDENSERS—ALL NEW

1—8533 sq. ft. 2—1050 sq. ft.
10—3800 sq. ft. 1— 700 sq. ft.
3—3300 sq. ft. 4— 300 sq. ft.
4—2200 sq. ft. 10— 400 sq. ft.
10— 206 sq. ft.—H.P. feed heaters. 8— 155 sq. ft.

REDUCTION GEARS

4—1800 HP 2.41:1 10—20 HP 41:1
10— 900 HP 2.48:1 10—11 HP 39:1
10— 25 HP 20:1 10—10 HP 1750:63
7—Waterbury hydr. type K, size 35, 5 and 2A

HOISTS

10—100,000# pull at 10 FPM to 3000# pull at 400 FPM, 2 Gypsies 12000# pull at 125 FPM, driven by 50 HP 230v. D. C. motors 525—1800 RPM.
15—15,000# pull at 78 FPM, 3360# pull at 348 FPM and 2 auxiliary drums. Driven by Chrysler 28.35 H.P. gasoline engines. (NEW).

AXIAL FLOW FANS

10,000 CFM, 3" S.P. 3/60/450 motors
5,000 CFM, 3" S.P. 3/60/450 motors
Rugged construction, acid resisting vanes, totally enclosed motors, all NEW

WIRE ROPE SLINGS

⅝" to 2½" various lengths also steel blocks, treble, 18" Sheave, cap. 15 ts and 30 ts.

DIESEL ENGINES

	Make	Model	H.P.	R.P.M.	Cycle	Cylinders	Bore & Stroke	Year	Reverse Reduction Gear
4	General Motors	16-258S	1800	900	4	16	9 ½"×12"	1943	2.41: fluid coupling
2	Hamilton	R.B. 99-D.A.	1600	700	2	9	9 1/16"×13⅜"	1944	
8	Fairbanks Morse	38 D O/P	1600	720	2	10	8⅛"×10"	1944	Reversible, Hydr clutch
8	General Motors	16-278A.	1600	720	2	16	8¾"×10½"	1944	
35	General Motors	12-567ATL	900	744	2	12	8½"×10"	1942–44	Falk 2.5:1
2	General Motors	8-268A.	500	1200	2	8	6½"×7"	1943	2.54:1
2	Fairbanks Morse	38 O/P	300	1200	2	6	5"×6"	1936	
4	Buda	6LD468	95	1850	4	6	4¼"×5½"		Driving Fire Pumps 1000 gpm, 280 ft. head.

Ask For Our Complete 1948 CATALOG

DIESEL GENERATOR SETS—A.C.

									KW	Volts	Cycles	Exciter Phase	Exciter KW	Exciter Volt
3	General Motors	8-268A	350	1200	2	8	6½"×7"	1943	200	440	60	3	40	120/240
2	General Motors	3-268A	150	1200	2	3	6½"×7"	1943	100	440	60	3	20	120/240

DIESEL GENERATOR SETS—D.C.

7	General Motors	16-278A	1600	750	2	16	8¾"×10½"	1943	1200	525	Allis Chalmers Type MHC 2290 AMPS
4	General Motors	12-278A	1200	750	2	12	8¾"×10½"	1943	1200	240	Elliott
2	General Motors	8-268A	500	1200	2	8	6½"×7"	1944	375	120/180/240	Westinghouse-
2	Superior	VDMB	215	600	4	5	9"×12"		125	120/240	Electro-Dynamic
50	Superior	GDB-8	150	1200	4	8	5⅛"×7"	1942–44	100	120/240	Delco 3 wire stab. shunt 60° C rise-
4	General Motors	3-268A	150	1200	2	3	6½"×7"	1943–44	100	120/240	Allis Chalmers 3 wire stab. shunt

WRITE OR CALL FOR DETAILS

HUGO NEU CORPORATION

31 Nassau Street New York 5, N. Y.
Tel. REctor 2-1334

ARRANGE FOR INSPECTION

POWER EQUIPMENT—READY TO SHIP

SAVE OVER 50% ON NEW INDUSTRIAL BLOWERS AND VENTILATING FANS

AXIAL FLOW VENTILATING FANS

5—50" dia. 72½" long, 2 sets of propellers, 8 blades to each. Dim: of blade, 14"x 9½" curved mfg'd by International. Size 114, driven by 100 HP., 1750 rpm., 220/440 v. 3 ph. 60 cy. A.C. Motor.
6—16000 CFM Buffalo Forge Co., 3" stat. pres. 1800/1200 rpm. con. 15/4.5 HP., 1710/1150 rpm., 3 ph. 60 cy. G.E. A.C. Motor 220/440 v. totally encl.
2—12000 CFM 3" stat. pres. Sturtevant with dir. con. 10/3 HP., 1775/1180 rpm., 220/440 v. West. CS. TEFC Motor.
1—7500 cfm Clarage with dir. con. 7½ hp., 1750 rpm., 3.3 HP. at 1160 rpm., 220/440 v. 3 ph. 60 cy.
2—6000 cfm Sturtevant 1.65" stat. pres. dir. con. 2.7/.8 HP. 220/3/60 A.C. Motor.
31—6000 cfm Sturtevant Bulletin 512389, 3" stat. pres. 7 blade, dir. con. 5/1.5 HP., 1765/1175 rpm., 220/440 v. 3 ph. 60 cy. West. TEFC Motors.
2—5000 cfm Sturtevant 1.8 stat. pres. 4.2/1.25 HP., 1750/1150 rpm., 3 ph. 60 cy., 220/440 v. ball bearing motors.
2—4000 cfm 3" stat. pres. Sturtevant dir. con. 2 speed, TE Westinghouse 220/440 v. Motors.
1—4000 cfm 3" stat. pres. Sturtevant Axial Flow vent fan dir. con. 4/1.2 HP., 1750/1150 rpm., 220/440 v., 3 ph. 60 cy. Tot. Enc. West. Motor.

115 Volt, D. C.

8—4000 CFM Sturtevant 3" stat. pres. 115 v. Westinghouse SK Motors.
4—4000 cfm American Blower 3" stat. pres. 4/1.7 HP., 1750/1310 rpm., 115 v. Westinghouse SK Motors.
1—3000 cfm 3" stat. pres. B. F. Sturtevant 1750 rpm., dir. con. 3/1.25 HP., 115 v. D.C. Motor.
1—250 CFM—2½" stat. L. J. Wing, with dir. con. 1/5 HP., 3300 rpm. Diehl Motor.

NEW—CENTRIFUGAL BLOWERS

1—Roots Connersville Industrial Blower 16 x30 with 8 to 1 ratio gear reduction unit, dual shaft unit with single pulley shaft complete with 75 P. 220 or 440 v 3 ph. 60 cy. A.C. Motor.

A. C. MOTORS

3 ph. 60 cy.

No.	HP	Type	Make	RPM	Volts
1 New	500	Syn	Elec. Machy.	120	2200/4000/440/220
1	200	CS	West.	900	220/440
1	150	Syn	West.	257	220/440
1	150	CS	West.	720	220/440
1	150	CS	West.	1700	2200
4	150	FX	Louis Al.	1800	220/440
1	125	Syn	Elec. Machy.	164	220/440
2	125		Reliance	600	220/440
2	125		West.	720	2200/220/440
2	100		Reliance	495	220/440
2	100		West.	500	2200/220/440
2	100		G.E.	600	220/440
2	100	Syn	Elec. Machy.	720	220/440
5	100	TEFC	Master	1750	220/440
2	75		G.E.	490	220/440
1	75	Syn	Elec. Mach.	900	220/440
1 New	75	CS	West.	3600	220/440
3	50	K	G.E.	1800	220/440

BRAND NEW SAFETY SWITCHES

3 P. S. T.

800—60 amp., 550/440 or 220 v. A.C. Wadsworth non-fusible Safety Switches, Catalog No. 8963.
Price $10.50 each.
77—60 amp., 230 v. A.C. Wadsworth—fusible Safety Switches, Catalog No. 8763A.
Price $13.50 each.
• Special Discounts on quantities.

NEW FLEXIBLE COUPLINGS •

1200—New Lovejoy bronze flexible couplings 1" bore with Neoprene spider, Cat. No. 1A-100, can be bored to 1⅛", 1¼" and 1⅜". Can be bushed down to ½" Price $4.85 each.
• Special Discounts on quantities.

MOTOR GENERATOR SETS

250 V. D. C.

Motors 220/440 or 2200 v. 3 ph. 60 cy.

No.	KW	Make	Speed
1	150	West.	1800
1	135	G.E.	1200
1	100	West.	1800
2	100	Delco	1150
2	75	West.	720
1	50	Cr. Wh.	900
2	50	West.	490
1	40	G.E.	720
3	40	West.	900
1	40	G.E.	1750
1	35	G.E.	850 (850)
1	30	G.E.	680
1	30	West.	850
1	25	West.	1150
1	20	G.E.	1150
2	20	Delco	1200
2	15	West.	1800
1	7½	West.	1150
1	5	Wes	1150

VARIABLE SPEED MOTORS

230 V. D. C.

No.	HP	Make	Type	RPM
2	200	Reliance	1970T	400/1200
3	133	G.E.	CDM	875/1750
8	100	Reliance	1050T	400/1000
4	50	West.	SK-190	320/960
4	50	West.	SK	300/1200
1	45	West.	SK-143	500/1500
1	40	West.	SK-180	385/1200
1	40	Al. Chal.		400/1200
1	35	West.	SK-143	500/1500
1	30	G.E.	DLC-50	400/1200
1	20	West.	SK-123	400/1600
1	20	West.	SK-110	500/1500
1	15	West.	SK-100	500/1500
2	10	G.E.	RF	400/1200

TRANSFORMERS

1 ph. 60 cy.

No.	KVA	Make	Pri.	Sec.
25 new	25	Allis Chal.	450	120
20 new	25	Allis Chal.	440	110/220
15 new	25	Allis Chal.	220	220/110
3 new	37½	West.	450	120
1	50	G.E.	2300	220/440
3	50	West.	11000	2200

SLIP RING MOTORS

3 ph. 60 cy.

No.	HP	Type	Volts	Make	RPM
2	700	MT-415	2200	G.E.	900
2	600	MT	2200	G.E.	900
2	400	MT	2200	G.E.	900
1 new	200		220/440	G.E.	600
1	75	I-M	220/440	G.E.	600
6	50	CW	2200/220/440	West.	860

CIRCUIT BREAKER

1—3000 Amp. ITE, type LG, 6 pole, rigid arm, solenoid operated, for 440 v. 3 ph. 60 cy.

SURFACE COMBUSTION GARDEN CITY HEAT TYPE EXHAUSTERS

3—#55 Single SSP, 14000 cfm at 1298 rpm., S.P. @ 70 deg. F and 8" water for 1200 deg. F. operation.
2—#50 Single SSP, 10000 cfm at 1375 rpm., S.P. @ 70 deg. F and 8" water for 1200 deg. F. operation.

SPECIAL BARGAIN AIR COMPRESSORS

7—240 CFM Westinghouse type 3 VS-23 3 cyl. vert., 150 lbs. pres. dir. con. to 50 HP., 220/440 or 2200 v. 3 ph. 60 cy. West Slip Ring Motors, auto. control. Can furnish D.C. Motors or Oil or Gasoline Engines if desired.

WELDING and CHARGING SETS

1—Chandeysson 50 KW., 40 V. D.C. 600 rpm. 75 H.P. Synchronous Motor 220/440 v. 3 ph. 60 cy., with exciter 100% P.F.
1—Thompson Shell Welder including West. control, 6 electronic tubes, ½ HP. A.C. Motor.
1—Federal special seam welder 200 kva., 220/440 v. 60 cy. 5 DC max. sec. amps. 34000 at ¼x33 throat, sec. volts 5.1 10.2 max. air pres. 90 min. water inlet pres. 65 lbs. 70 deg. F. max.
1—Federal seam welder 150 kva., 220/440 v. 60 cy., .5 DC max. sec. amps. X30,000 at 4 BY-28 throat sec. volts 4-8 max. air pres. 90 deg. min. water inlet pres. 50 lbs. at 70 deg. F. 1 HP. A.C. Motor.

DYNAMOMETER

"Hi-Eff" hydraulic size 35#, model 58S, 3100 rpm., Taylor Mfg. Co.

FREQUENCY CHANGERS

1—25 kw., 220/440 v. 3 ph. 180 cy., G.E. dir. con. to 25 HP., 1800 rpm., 220/440 v. 3 ph. 60 cy. Motors.

SYNCHRONOUS MOTORS

1—New 500 HP., Elec. Machy. Co. 2200/220 or 440 v. 120 rpm.

ENGINE GENERATOR SETS

10—NEW 1 kw. 14.25 v. D.C. and 2 kw., 28.5 v. D C. Homelite portable gas eng. Gen. sets. Can furnish lamps and batteries. Suitable for farms and camps.
3—5 kva. 120/240 v. 1 ph. 60 cy. Witte Diesel.
1—10 kw., 115 v. D.C. 1200 rpm., Hercules DIESEL.
30—NEW 25 kva. West. 120/208 v. 1 and 3 ph. 60 cy. LeRoi GAS.
1—35 kva. 220/440 v. 3 ph. 60 cy. 257 rpm., Ridgway STEAM.
3—100 kw., 240/120 v. Delco 1200 rpm., dir. driven by 150 HP. Superior GBD-8 5½" x7" 8 cyl. DIESEL.
1—125 kva. G.E. 220/440 v. 3 ph. 60 cy., dir. con. Skinner UNIFLOW Engine.

INDUCTION HEATING CONVERTER

New Van Norman, type indoor, floor, hi-freq. 32 kw. 220 v. 1 ph., 60 cy. 150 A. enclosed type.

PUMPS

3—1000 GPM Worthington Cent. 1 stage, 6½" suc. 5" dis. 150# pres. dir. con. 133 HP., 875-1750 rpm., 230 v. D.C. Motors and control. (Can furnish A.C. Motors if desired.)

WINCHES

240—Winch assembly portable engine hoists, swivel hook, 4¾" l, with 1½" opening and 30' of ¼" cable. Hand cranked, double reduction gear with drum 5¾" w. can be used with A.C. or D.C. Motors.

CONDENSER

450 kva., Elec. Machy. 2200/220 or 440 v. 3 ph. 60 cy., 120 rpm.

CAR PULLER or WINCH

1—Welen, 2 drum Winch or Car Puller rated 8600# per drum with 25 HP. G.E. Vertical Motor 230 v. D.C.

SPEED REDUCER

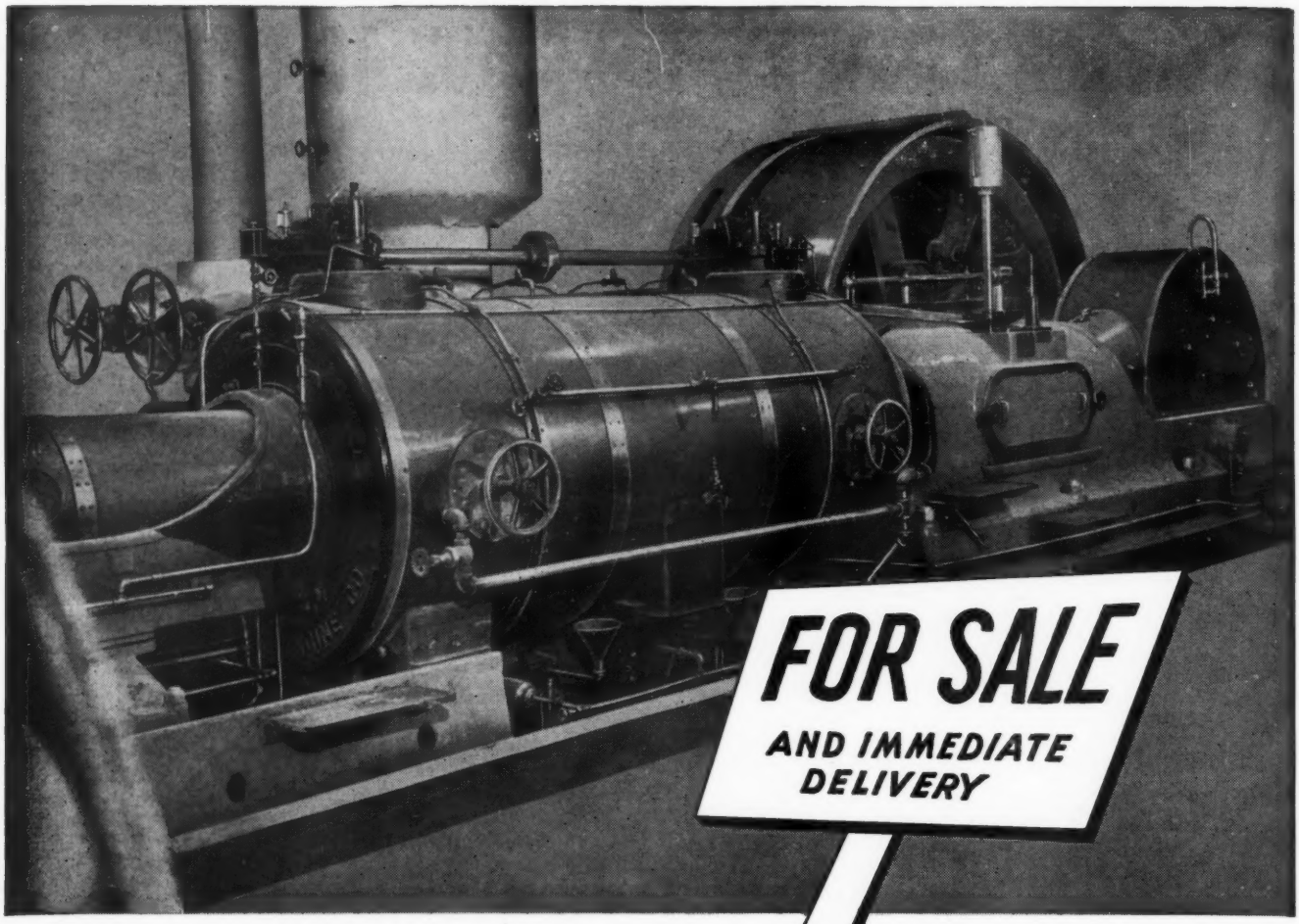
800 HP. United Engineering Co., double reduction gear Drive ratio 16.4 to1, used with 800 HP., 360 rpm. motor.

GEAR HEAD MOTOR

50 HP., G.E. 220/440 or 550 v., 3 ph. 60 cy., 1755 to 13 rpm., splash proof, ball bearing.

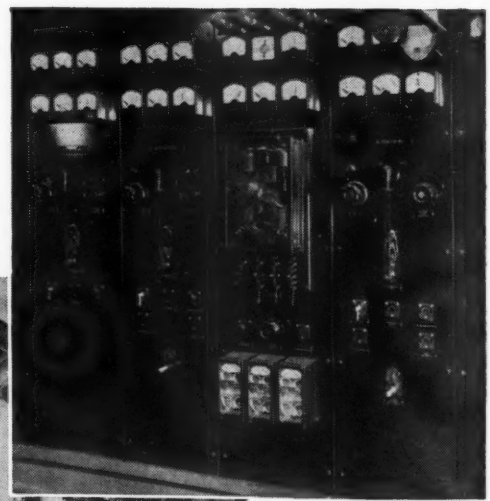
WRITE, WIRE OR PHONE YOUR ELECTRIC NEEDS—SEND FOR STOCK LIST. LIST YOUR IDLE EQUIPMENT WITH US

Duquesne Electric & Mfg. Co. Pittsburgh 6, Pa.



2 Complete, Modern

575 KVA SKINNER UNAFLOW ENGINE GENERATOR UNITS



2— 750 HP Skinner unaflow engines, each directly connected to 575 KVA Westinghouse 220 volt, 3 phase, 60 cycle, 150 RPM alternating current generator, with

15 KW "V" belt-driven exciters

Complete switchboard control apparatus, with switchboard operated variable speed synchronizing devices and automatic voltage regulators.

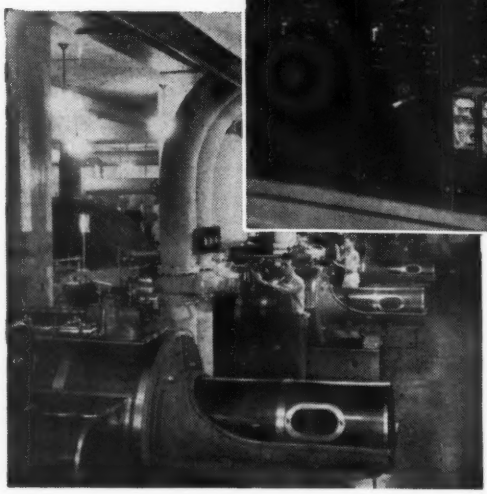
Also Available:

2— surface condensers with motor-driven circulating pumps.

2— 250 HP low pressure condensing steam turbines with auxiliaries.

This plant is one of the most modern medium-size steam power plants on the West Coast. It is complete in every detail.

The units were installed in 1935 and furnished complete power service for the building and presses of the Los Angeles Times. The plant has always been well maintained and is being removed from the Times Building now only because it is too small to furnish power for the building which is being enlarged to double capacity.



This complete steam power plant is offered for immediate shipment, F.O.B. Los Angeles. For further information write or telephone.

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"CERTIFIED REBUILT"

FOR MORE THAN 40 YEARS

THE MARK OF DEPENDABLE ELECTRICAL EQUIPMENT

MOTORS . . . GENERATORS . . . M-G SETS

PUMPS . . . FANS . . . BLOWERS . . . SPEED REDUCERS

PARTIAL STOCK LISTINGS—WRITE, WIRE OR PHONE YOUR REQUIREMENTS

M-G SETS

KW	Mfr.	Input V	Output V
500	Gen. Elec.*	440 AC	250 DC
150	Cr. Wheeler*	220/440 AC	250 DC
105	Century b.b.	220/440 AC	70 DC
100	Gen. Elec.*	220/440 AC	125 DC
100	Allis Ch.*	2300/4160 AC	125 DC
75	Star b.b.*	220/440 AC	250 DC
75	Star b.b.	240 DC	230/460 AC
40	Whse.	220/440 AC	250 DC
40	El. Prod.	220/440 AC	125 DC
35	Gen. Elec.	220/440 AC	48 DC
30	Marbie Card	220/440 AC	60 DC
30	Elec. Prod.*	220/440 AC	50 DC
25	G. E. NEW	220/440 AC	125 DC
20	Whse.	220/440 AC	250 DC
15	Gen. Elec.	220/440 AC	125 DC
9	H.V.W. 1500 Amp.	220/440 AC	6/12 DC

*Synch. motor drive.

D. C. MOTORS

H.P.	Mfr.	Type	Volts	Speed
150	Cr. Wheeler b.b.	TEFC	230	890
100	Whse.	SK181	230	450/900
75	Allis Ch.	E	230	800
75	Allis Ch.	E	230	500
75	Whse.	S13L	115	575
75	Gen. Elec.	BRC	115	1150
65	Gen. Elec.	C	230	375/750
50	Whse.	SK160	230	550/1100
40	Whse.	SK	230	1700
40	Whse.	SK133	230	850
35/50	Gen. Elec.	CD123	230	575/1150
30	Whse.	S-7	115	900
30	Whse.	SK160	230	350/1000
30	Star b.b.	SB	230	1750
25	Whse.	SK100L	230	1100
25	Sprague dyna.	LC	230	750/2000
25	Chand'son (4)	C13	115	850
25	G.E. b.b. NEW	CDM93	115	1150
20	Gen. Elec.	RC	230	1150
20	Gen. Elec.	RF12	230	400/1600
20	Whse.	SK93	230	1150
20	G.E. b.b. NEW	CDM83	115	1750
20	Gen. Elec.	RC11	115	1150
20	Reliance	T	230	850
20	Gen. Elec.	DLC	230	500/1500
15	Gen. Elec.	LC	230	550/1100
15	Gen. Elec.	RC	115	1150
15	Roth	85RS	230	1750
15	G.E. b.b. NEW	CDM67	115	1750
15	Gen. Elec.	RC10	230	1150
15	Whse. (5)	SK90	230	825

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
600	Gen. Elec.	MPC	500	750
150	Milwaukee	A	250	600
150	Cr. Wheeler b.b.	TEFC	250	1200
105	Century b.b.	1500a	70	1200
100	Gen. Elec.	RC17	125	1200
75	Allis Ch.	E	250	1100
75	Whse.	S	125	600
40	Gen. Elec.	RC	250	1500
40	Whse.	SK	250	1150
30	Elec. Prod.	BB	50	1150
25	Whse.	SK	250	1750
25	G.E. NEW b.b.	CD93	125	1450
24	Whse.	SK	600	850
20	Reliance	T	250	1150
15	Gen. Elec.	RC	125	1200

EXPLOSION PROOF MOTORS—NEW

1—3 HP 1200 RPM
2—7½ HP 1800 RPM
1—7½ HP 900 RPM
3—5 HP 1800 RPM
1—10 HP 900 RPM
1—15 HP 1800 RPM
2—20 HP 1800 RPM

A. C. MOTORS—25 CYCLE

H.P.	Mfr.	Type	Volts	Speed
300	Whse.	Synch.	2300	750
150	Whse.	Synch.	440	750
150	Whse.	HF	440	500
50	G.E. int.	MTC5337	440	750
50	Allis Ch.	ANY	440	1500
40	G.E.	I-K	440	750
30	G.E.	KT	440	750
25	Howell	SR	440	750

A. C. GENERATORS—60 Cycle

KVA	Mfr.	Type	Volts	Speed
625	Gen. Elec.	ATB	2300	450
500	Allis Ch.	3 brg.	240/480	360
300	Gen. Elec.	ATB	240/480	720
250	Whse.	G	2300	600
200	Gen. Elec.	ATB	240/480	900
156	G.E. 1 brg.	ATB7558	240/480	1200
125	Whse.	G	240/480	720
125	Gen. Elec.	ATB	240/480	300
125	Whse. 25 cycle	G	240/480	750
100	Whse.	G	2300	900
63	El. Machy.	180 cy.	240/480	1800
60	El. Machy.		240/480	900
56	Gen. Elec.	ATB	240/480	900
50	Cont. b.b.	S107	120/208	1200
12½	Whse. b.b. NEW		240	1200

A. C. MOTORS—SLIP RING

3 phase 60 Cycle 220 or 440 Volts

Qu.	H.P.	Mfr.	Type	Speed
1—	600	Gen. Elec.	I-M	360
1—	450	G.E. 3 brg. 2200 V.	I-M	450
1—	300	G.E. 2200 V.	I-M	1800
1—	200	G.E. 2200 V.	IM-15A	720
1—	150	Whse.	HF	720
1—	150	G.E. 2200 V.	I-M	1200
1—	150	G.E. int. duty	ITC-15	720
1—	125	Wagner 2200 V.	BR	900
1—	100	Allis Ch.	ANY	1800
1—	100	Al. Ch. b.b. NEW	ARY	600
2—	100	Wagner 2200 V.	RS-26V	1200
2—	100	Whse. int. 2200 V.	CI856C	600
1—	75	Ideal	AV	1200
1—	75	Gen. Elec.	MT558	600
2—	75	Gen. Elec.	IM-14	600
1—	75	Gen. Elec.	MT337	1800
1—	50	Fair Morse	BV	720
1—	50	Gen. Elec. int.	ITC	600
1—	50	Whse. int.	CI	600
1—	50	Gen. Elec.	I-M	720
2—	40	Gen. Elec.	MT336	900
1—	40	Allis Ch.	ANY	450
1—	37	G.E. int.	ITC	600
1—	35	Lancashire	b.b.	1800
1—	30	Gen. Elec.	OMT336	1200
1—	30	Gen. Elec.	MT346	600
1—	25	Triumph	SR	1200
1—	25	Gen. Elec.	I-M	600
1—	20	G.E. int.	MTC5312	900
1—	20	G.E. b.b.	MT503	1800
1—	20	P & H b.b. int.	W18	1200
1—	20	Gen. Elec.	MT332	720
2—	20	G.E. int.	MTC5302	1200
1—	15	Gen. Elec.	MT502	1200
1—	15	Watson	KHV	720
1—	15	P & H b.b. int.	W7	1200

A. C. MOTORS—SYNCHRONOUS

H.P.	Mfr.	Type	Volts	Speed
667	Gen. Elec.	ATI	2200	450
300	Whse.	G	2200/440	600
250	Ideal	2BC-M4	2200	450
200	Gen. Elec.	ATI	220/440	900
150	Gen. Elec.	ATI	2200	450
150	Gen. Elec.	ATI	220/440	300
150	Gen. Elec.	ATI	220/440	600
125	Whse.	G	2300	900
125	G.E. splprf.	TS955	220/440	1200
100	American b.b.	YGH	220/440	900
75	El. Machy	BRKT	550	900
60	Gen. Elec.	ATI	220/440	900

A. C. MOTORS—SQUIRREL CAGE

3 Phase 60 Cycle 220 or 440 Volts

Qu.	H.P.	Mfr.	Type	Speed
1—	250	G.E. 2200 V.	I-K	600
1—	200	Reliance b.b. NEW	C6085	1800
1—	150	Reliance b.b. NEW	14C6085	720
1—	150	Gen. Elec.	I-K	900
1—	150	Whse. 2200 V.	CS771-1C	1800
1—	150	Reliance b.b. NEW	B6085	1200
1—	150	Reliance b.b. encl.	AA	900
1—	150	Fair. Morse	B	600
1—	125	Cont. 2200 V. b.b.	SC	1800
1—	125	Rel. TEFC NEW	B6085	1800
1—	100	Rel. TEFC NEW	C5085	1200
1—	100	G.E. b.b. NEW	K504S	1800
1—	100	Gen. Elec.	KT343	1800
1—	75	Reliance TEFC NEW	C5084	1200
1—	75	Reliance b.b. NEW	C505	1800
1—	75	Gen. Elec.	KT329Y	3600
1—	75	Gen. Elec.	I-K	720
2—	75	Reliance b.b. NEW	C505	1200
2—	60	Reliance b.b. NEW	B504	1800
1—	60	Rel. TEFC NEW	C505	1200
2—	60	Reliance b.b. NEW	C504	1200
1—	60	Allis Ch. 4000/2200 V.	AR623	1800
1—	60	Gen. Elec.	I-K	600
1—	50	G.E. TEFC b.b.	KF445	3600
1—	50	Whse. b.b. NEW	CS405S	1800
1—	50	G.E. 2 phase	I-Q	900
2—	50	G.E. NEW b.b. HT	KG405	1800
2—	50	Reliance b.b. NEW	C445	1200
2—	50	Gen. Elec.	KT336	1200
1—	50	Gen. Elec.	KT342	900
2—	50	Whse. hislip	WL607	900
1—	40	G.E. hitorq	FTR532	1200
1—	40	Howell b.b.	SC	1800
1—	40	Al. Ch. 3 speed	ARX	900/600/450
5—	40	Gen. Elec.	KT336	900
2—	40	G.E.	KT	1200
2—	35	Gen. Elec.	I-K	720
2—	30	Howell b.b. 4 speed	SC	1800
2—	30	G.W. NEW b.b.	K365	1800
2—	30	G.E. NEW hitorq	KG365	1800
2—	30	Whse. NEW b.b.	CS405	1200
2—	30	G.E. TEFC b.b.	K404	1800
1—	30	Gen. Elec.	I-K	900
1—	30	Gen. Elec.	KT336	720
1—	30	Wagner	22T8P	900
1—	30	Whse.	CS646	900
2—	30	Reliance TEFC NEW	C444	1200
5—	25	Reliance b.b. NEW	C364	1800
2—	25	Reliance TEFC NEW	B365	1800
2—	25	Reliance b.b. NEW	C404	1200
2—	25	Reliance TEFC NEW	C405	1200
2—	25	Whse. NEW spl. b.b.	CS365	1800
1—	25	Gen. Elec.	IK	1200
1—	25	Allis Ch.	AN	1200
3—	25	Whse.	CS646	900
2—	25	Gen. Elec.	I-K	600
1—	20	G.E. TEFC b.b.	K404	1200
1—	20	U.S. NEW b.b.	SC326	3600
1—	20	Gen. Elec.	KT182	3600
4—	20	Reliance b.b. NEW	C364	1800
2—	20	L.A. NEW exp. prf.	EX364	1800
2—	20	Whse. NEW b.b. spl.	CS364	1800
2—	20	Gen. Elec.	KT312	1200
2—	20	Gen. Elec.	I-K	1200
1—	20	Whse.	CS	1200
1—	20	Gen. Elec. b.b.	I-K	900
2—	20	G.E. NEW b.b.	K365	1200
2—	20	Diehl TEFC NEW	INF364	1800
2—	20	Century b.b. 4 speed	SC594	1800
2—	15	Whse. Splashprf.	C3365	1200
2—	15	Whse. TEFC NEW	CS365	1200
4—	15	G.E. NEW b.b.	K324	3600
2—	15	Diehl NEW b.b.	D1326	1800
2—	15	Whse. NEW TEFC	CS326	1800
1—	15	Diehl. TEFC NEW	INF365	1200
4—	15	Gen. Elec.	KT302	1200
1—	15	Gen. Elec.	KT512	900
1—	15	L. Allis	OX365	900

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COMPLETE BOILER PLANT

Erie City Boiler, 45,000# per/hr., 180# pressure, ASME Code. Pulverized coal fired. Excellent condition.

AIR CONDITIONING UNITS

1—Frigidaire—20 ton capacity.
1—Carrier—30 ton capacity.

DIESEL ENGINES

3—Buda, Model 6LD468, 68 H. P.
1—Hercules, Model DWXDS, 150 H. P.

AIR COMPRESSOR

Ingersoll Rand, type 40, 7" x 6¼" x 5", 194 CFM, 100# W.P., 40 H. P., TEFC, 3/60/220/440 volts with Control. New 1942.

BUCKET ELEVATORS

3—46', 48', 68' Centers.

DIESEL LOCOMOTIVE

1—45-ton, General Electric-Cummins Standard Gauge.

MISCELLANEOUS

AIR RECEIVER—5' diam. x 14'.

BLOWERS—Buffalo, Roots, American, etc. Up to 60,000 CFM.

MOTORS—NEW ¼ H. P. to 125 H. P., X. P., TEFC, Open.

PUMPS—Duriron, Allis Chalmers, etc. Up to 2000 GPM.

REDUCERS—Philadelphia, Farrell-Birmingham, Cleveland, etc. Up to 57 H. P.

STEEL STORAGE COAL BIN—275 ton, riveted.

TRANSFORMERS—7½ KVA TO 500 KVA.

WELDERS—300 and 400 amps., Gen. Electric and Hobart.

DIESEL POWER GENERATORS

*AC or DC

Quan.	KW	Make	Model	HP	RPM
3	300	Gen. Motors	8-268A	450	1200
5	100	Superior	GDB-8	150	1200
3	100	Gen. Motors	3-268A	150	1200

*DC GENERATORS—120/240 VOLTS
AC GENERATORS—ANY VOLTAGE

Heat and Power Co., inc.

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FOR SALE

4000 KW TURBINE GENERATING PLANT

Consisting of

1—2000 KW and 2—1000 KW General Electric, 3 phase, 60 cycle, 480 Volts, 3600 R.P.M. Condensing Turbo Generator Units. Complete with all Auxiliaries. General Electric inspection reports are available.

A. G. SCHOONMAKER CO., INC.

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VACUUM PUMP

36" x 14" C.P. Duplex with 250 HP, 440-3-60 225 RPM synchronous motor, MG set & Control Panel. New 1943—Used 2 mos.

AIR COMPRESSORS

2—12" x 10" Sullivans. Other sizes from ½ HP to 100 HP in stock.

PUMPS

3—16" ALV Camerons 8000 GPM 65' hd. 870 RPM.

COMPLETE LINE OF HOISTS, PUMPS & MACHINERY OF ALL KINDS

WRITE US FOR YOUR REQUIREMENTS

C & S MACHINERY CO.

715 Howard St. St. Louis 6, Mo.

Reliably Rebuilt—YEAR Guarantee

A.C. Squirrel Cage Motors

H.P.	Make	Type	Speed
200	Al. Ch.		600
150	Al. Ch.		514
147	West.	25 cy.	715
125	El. Prod.	B.B.	1150
125	Al. Ch.		450
100	G.E.	KT	1800
100	West.	CS	1800
100	G.E.		1200
75	Al. Ch.		3600
75	G.E.	1K	1800
75	G.E.	KT-347	1200
60	G.E. (2)	KG	1800
50	Ideal	A	1150
50	G.E. (2)	XP	1800
50	E.D. (5)	TEFC	1800
25	West.	3S-364	3450

A.C. Clipring Motors

600	Cr Wh.	25 cy.	480
100	Wagner	25 cy.	480
75	G.E.	IM	690
60	G.E.	TEFC	720
50	Al. Ch.	ARY	600
50	G.E. (2)		514
40	G.E.	IM	1200
40	G.E.	MT-352	600
30	West. (2)	CI	900
30	G.E.	MT-542	720

A.C. Synchronous Motors

600	G.E.		900
400	G.E. (4)	TS	600
2-200	Ideal		257
50	G.E.		1200

Generators

KW	Make	Speed
150	G.E.	600

D.C. to A.C. Gen.

KW	Make	D.C.	A.C.
25	G.E.	230	220
25	Star	115	120
25	Ideal	115	440
25	El. Mchy.	230	440
7½	Hertner	115	440
5	El. Spec.	110	110

230 V. Variable Speed D. C. Motors

H.P.	Make	Type	Speed
100	Rel.	1050T	400/1000
100	G.E.	CD173	400/1200
75	Cr. Wh.	CMC	375/750
60	G.E.	C	480/1100
55	Cr. Wh.	CMC	165/500
50	West.		250/1000
50	West.	SK	500/1500
40	G.E.	CD	500/1500
35	G.E.	RF	500/1500
25	G.E. (3)	RF12	500/1500
25	G.E.	RF13	400/1600
25	West.	SK140	400/1200
20	G.E. (2)	RF12	400/1200
15	West. (3)	SK93	600/1750
15	West.	SK93	600/1200
15	E.D.	10S	500/1500
15	West.	SK	250/1500
10	G.E.	RF10	600/1800
10	West.	SK	600/1200
10	G.E.	RF	400/1600
10	G.E.	RF	400/1200

230 V. D.C. Motors

150	G.E.	RC19	800
100	G.E.	CDP	1750
100	Al. Ch.		900
75	West.	SK180	475
75	West.	SK170	635
60	West.	SK160	680
50	West.	SK133	1300
50	Diehl	K10	850
50	West.	SK	750
50	West. (3)	SK160	585
40	G.E.	RC	1750
40	West. (2)	SK103	1750
40	G.E.	RC	1075
35	West.	SK	1150
30	G.E.	RC	1100
30	West.	SK	975
30	G.E. (2)	RC	775
30	West. (2)	SK143	575
30	G.E. (2)	RC33	775
25	Rel.	92T	1150
25	West. (4)	SK113	860
25	E.D.	10S	800
20	West.	SK60	1750
20	West.	SK83	1750
20	G.E.	CD	1200
20	Star (2)	SHB30	29

115 V. D.C. Motors

30	C.W.	CCM-FH	850
25	G.E.	CDM85	1800
25	G.E.	CDM95	1200
20	G.E.	CD83	1750
20	West.	SK110L	750

600 V. D.C. Generators

KW	Make	Speed
200	Cr. Wh.	900
30	Burke	1750
30	E.D.	1150

250 V. D.C. Generators

KW	Make	Speed
330	Elliot	1200
300	G.E.	1200
200 (3)	G.E. MPC	1200
150	West.	900
150	West.	1180
150	G.E.	600
50	G.E.	1200
30 (3)	G.E.	1750
30	Cont.	1200
2[illegible]	G.E.	1200
15	G.E.	1750
10	Star	1750
7½	West.	1200
5	West.	1750

125 V. D.C. Generators

KW	Make	Speed
250	G.E.	720
150	Cr. Wh	1200
100 (2)	West.	900
100	G.E.	1200
100	El. Mchy.	1200
75	Cr. Wh.	1200
75	Hertner	1150
50	Sturt.	2800
40	Cent.	1450
20	Delco	1200
15	G.E.	1150
10	Rogers	1450
7½	West.	1200
5	G.E.	1750

Low Voltage D.C. Generators

Amp.	Make	Voltage
8000	H-V-W.	6/12
6000	Chandeysson	6/12
6000	M-B-O'C. (2)	6/12
5000	M-B-O'C. (2)	6/12
5000	Col.	8/16
2000	H-V-W.	6/12
1000	Chandeysson	6/12
1000	Col.	6/12
125	Hobart (8)	7½
1000	H-V-W.	12/24
300	Star	15
67	Cont.	15
750	Star	15
1000	G.E.	15
800	G.E	22/23
600	Rel.	24
134	West.	24
175	Cr. Wh.	25
550	Col.	27
1600	G.E.	30
800	G.E.	30
100	G.E.	30
200	West.,	30
205	G.E.	32
1000	G.E.	33
205	G.E.	42
24	G.E.	44/54
75	G.E.	50/10
800	G.E.	50
1500	G.E.	50
400	G.E.	60
1500	Century	60
1500	El. Prod.	65
1000	G.E.	75

ONLY PARTIAL LIST—SEND FOR No. 15

EST. 1910 → L. J. LAND INC. ← 39TH YEAR

New England Representative:
BOSTON, MASS.
411 Atlantic Ave.
Phone: Liberty 4300

146 GRAND STREET, NEW YORK 13, N. Y.
PHONE: CAnal 6-6976

South Western Representative
HOUSTON, TEXAS, 1400 Carr St., Phone: Charter 4-6558

Pennsylvania Office
READING, PENNA.
10th & Exeter Sts.
Phone: Reading 2-6866

FOR SALE

1—250 KW GE turbo-generator unit. Steam conditions 525#, 350° superheat, condensing. Generator 3-phase, 60 cycle, 450-volts, 1200 RPM with 40 KW exciter.

Machine New in 1941

G. DeRose
408 Donovan Bldg. Detroit, Mich.

DIESEL-GENERATORS

5 KW. TO 1000 KW.
NEW-USED
RECONDITIONED

J. PARKER THOMPSON CO., INC.
507 FIFTH AVE., NEW YORK 17, N. Y.
MURRAY HILL 7-6547

POWER PLANT EQUIPMENT

Special Offerings

TURBO-GENERATORS

1—3500 KW 2300 V. Cond
1—3000 KW 600 V. Cond
2—2500 KW 440 V. Cond
1—2500 KW 2300 V. Cond
1—2000 KW 600 V. Cond
1—1500 KW 2300 V. Cond
1—1500 KW 600 V. DC Cond
2—1250 KW 2300 V. Cond
2—1000 KW 480 V. Extrac.
1—1000 KW 2400 V. Cond
1— 750 KW 2300 V. Cond
1— 600 KW 240 V. Cond
1— 500 KW 600 V. DC Cond
1— 500 KW 480 V. Cond
1— 500 KW 480 V. Extrac.
1— 250 KW 2300 V. Cond
1— 150 KW 2400 V. N. C.
2— 125 KW 220 V. N. C.
1— 125 KW 600 V. Extrac.
1— 50 KW 220 V. N. C.

BOILERS

1—150,000# 450# New
1— 30,000# 400#
1— 30,000# 425#
1—1030 HP 225#
4— 500 HP 200#
2— 500 HP 175#
2— 500 HP 400#
2— 480 HP 225#
2— 400 HP 180#
1— 400 HP 200#
1— 300 HP 200#
2— 250 HP 160#
1— 175 HP 15#
3— 158 HP 150#

TRANSFORMERS

3—667 KVA —2300/460
3—500 KVA 11,000/460
3—500 KVA 13,800/575
3—200 KVA 600/220/110

ENGINE-GENERATORS

1—375 KW 2300 V. Uniflow
1—168 KW 600 V.
1—168 KW 220 V. Uniflow
1—150 KW 240 V.
1— 75 KW 240 V. Uniflow

AIR COMPRESSORS

1—6000 CFM 50# Motor
2—5600 CFM 50# Motor
1—1200 CFM 100# Motor
1— 700 CFM 100# Motor
1— 400 CFM 100# Steam
1—6000 CFM 5.1# New
1—5000 CFM 10# Rotor Type Syn. Motor 440 V.

BELTED GENERATORS

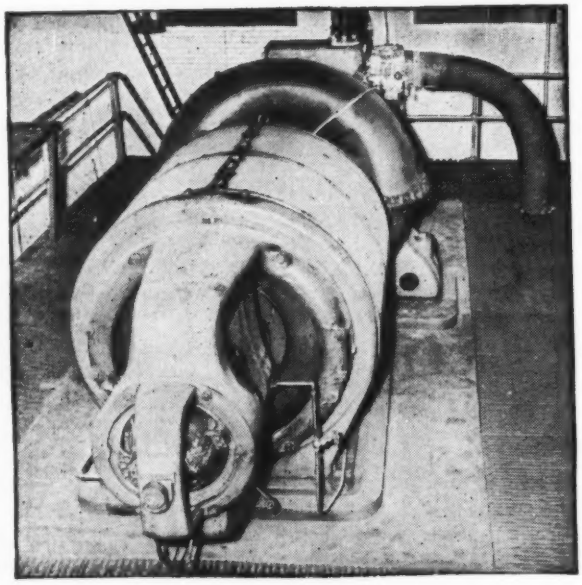
1—520 KW 360 RPM —550 V.
1—500 KW 225 RPM 550 V.
1—350 KW 300 RPM 550 V.
1—180 KW 600 RPM 550 V.

Write or wire for additional data and prints.

A. LEE ELLIS CO., U. S. Machy. Bldg., 140 Federal St., Boston 10, Mass.

The Buyers Must Be Satisfied—Always

1250 KVA GENERAL ELECTRIC CONDENSING TURBINE-GENERATOR UNIT AVAILABLE IMMEDIATE DELIVERY



Actual photograph—

1000 KW, type M, 18 stage condensing, 250 lbs. pressure, 100°F. superheat, 3600 RPM General Electric condensing steam turbine direct connected to a 1000 KW 80% P. F.—1250 KVA, type ATB, form HT, 3 phase, 60 cycle, 1203 amperes, 600 volts, 3600 RPM General Electric alternating current generator, serial #4219041 complete and equipped with 14 KW, 125 volt, 3600 RPM direct connected exciter, rheostats, a 2150 sq. ft. C. H. Wheeler surface condenser with condensing auxiliaries.

EXCELLENT CONDITION — A COMPLETE INSTALLATION

ELECTRICAL END CAN BE CHANGED OVER FOR EITHER 480 or 2300 VOLTS

UTILITIES ELECTRICAL MACHINERY CORPORATION

600 National City Bank Bldg., Cleveland 14, Ohio — Wire or Phone Long Distance 422

AT AUCTION

TURBO GENERATORS, BOILERS, PUMPS and EQUIPMENT of MUNICIPAL POWER PLANT

At the Electrical Department of THE BOROUGH OF PERKASIE, PA.
(Suburb of Philadelphia)

THURSDAY, AUGUST 5, 1948 at 11 A. M.

Daylight Time, On the Premises

The sale includes the following items to be sold in separate lots only

Allis Chalmers turbine driven generator unit 1250 KVA, 2300 V, 314 AMP, 60 C, 3 Ph., 3600 RPM driven by Allis Chalmers steam turbine with exciter, motors, Terry turbine, switch gears, Westinghouse alarms and Ingersoll-Rand centrifugal pumps. General Electric turbine driven generator 600 KW unit, 750 KVA, 3600 RPM, 2300 V, 188 Amp, 3 ph. with switch gear panel, 2 Cameron centrifugal pumps with circuit breakers and compensators. Vogt 334 H.P. conventional bent tube boiler with walkways, 2 water columns, valves, gauges, etc., capacity 40,000 lbs. steam per hour. Keeler 298 H.P. cross drum water tube boiler with similar equipment. 2 Worthington centrifugal boiler feed pumps driven by Terry steam turbines. Duplex boiler feed pump, Warren steam pump, Howell Red Band 5 H.P. vertical circulating pump 220/440 V, 60 C, 3 ph., 3450 RPM with G.E. motor and Ingersoll-Rand 2 H.P. circulating pump, 3470 RPM. Pennsylvania 8x9 Class 3 Air Compressor, 104 cu. ft. capacity per minute with 25 H.P. motor and operating equipment. 3 Kennedy Van Saun—one 4x7 ft. and two 3x7 ft.—Air Sweep pulverizing tube mills with motors and switches, Water Softener, Heater and Storage tank, conveyor, ash hoist, weighing equipment, quantity structural steel gratings, wallways, stairs, etc.

Present Borough requirements now exceed the capacity of this equipment. Consequently power is now being purchased from Penn Power and Light Company. Hence this sale at auction.

Descriptive Catalogs upon application to

27 William St., New York 5, N. Y.
80 Federal St., Boston 10, Mass.

SAMUEL T. FREEMAN & CO., *Auctioneers*
1808-10 Chestnut St., Philadelphia 3

POWER SPECIALS A PARTIAL LISTING FROM CHICAGO'S LARGEST STOCK.

2 COMPLETE VARIABLE SPEED DRIVES

M.G. Set
200 KW DC generator, General Electric, type MPC, 250 volt, 800 amp, 1200 RPM, direct connected to 300 HP synchronous motor, General Electric, type TS, 3 ph. 60 cy, 440 volt, .8 P.F. 1200 RPM. D.C. Motor.

250 HP, General Electric, type MPC, form A, 245 volt, 730/975 RPM.

With complete starting and control panels.

TRANSFORMERS

KVA	Type	Make	Pri.	Sec.
1-2500	Oil	Wstg.	2400	480
1-1500	Oil	Uptg.	34650	480
3-100	Dry	Wstg.	240/480	120/240
3-100	Oil	Wag.	4600/ 2300	460/230/ 115
6-75	Oil	G.E.	3400	6900/ 2300

A.C. GENERATORS

KVA	Make	Volts	Speed
1625	Wstghse.	2000	240
1125	Gen. Elec.	2200	257
1000	Wstghse.	2200	900
750	Gen. Elec.	2300	720
560	Al. Chlrs.	24	360

A. C. GENERATORS

KVA	Make	Volts	Speed
300	Al. Chlrs.	2300/4160	600
300	Gen. Elec.	480	450
200	Al. Chlrs.	2300	720
100	Gen. Elec.	2200	900
75	Al. Chlrs.	440	1200
60	F. Mrse.	2300	300
60	F. Mrse.	460	900
50	C. Whlr.	240	1200
30	Gen. Elec.	240	1200
12½	M. Card	127/220	1200

SYNCHRONOUS MOTOR SPECIALS

2—200 HP Allis Chalmers, 3 ph. 60 cy. 2300 volt, 100% P.F. 360 RPM, pedestal sleeve bearing, were used on compressors.

SYNCHRONOUS MOTORS

HP	Make	Type	Volts	Speed
1000	Wstg.		2300	900
885	G.E.	ATI	11400	514
800	E.M.		6600	450
700	Wstg.		440	900
500	E.M.		2300	514
450	E.M.	2 brg.	440	240
400	G.E.	TS	440	600
300	Al. Ch.		2300	600
300	E.M.	2 brg.	2300	900
300	Elec. Mach.		2200	514
250	Al. Ch.		2200	720
200	Al. Ch.		2200/440	360
100	G.E.	ATI	2300	900
75	Al. Ch.		240	1200
60	G.E.	ATI	220	900
60	Wstg.		220	1200

SQUIRREL CAGE MOTORS

HP	Make	Type	Volts	Speed
700	G.E.	KTP	440	1800
700	Wstg.	CS	4400/2200	1800
300	Al. Ch.		4500	720
200	G.E.	IK	2200	720
200	G.E.	KT	2200	600
200	Wstg.	CS	440	1800
150	Century		440	1800
125	Al.Chlrs.	AR	440	450
125	G.E.	K	440	1200
100	Al. Ch.	AR	440	514
100	U.S. E.	CFU	220/440	1200
100	G.E.	K	220	1200
75	G.E.	I	2200	720
75	Wstg.	CS	2200	900
75	G.E.	K	220	1200
75	G.E.	K	220/440	1800
60	G.E.	K	220/440	1200
60	Al. Ch.	AR	220/440	600
60	G.E.	K	220/440	1800
50	Wstg.	CS	220/440	900
50	G.E.	K	220/440	1800
40	G.E.	KT	440	900
40	G.E.	K	220/440	1200
40	Wstg.	CS	220/440	1800
30	G.E.	K	220/440	514
30	G.E.	KF	220/440	1200
30	Wstg.	CS	440	1800
25	G.E.	K	220/440	1200

ROTARY CONVERTERS

3—375 KW General Electric, type HCC, 6 ph, 60 cy. comp. int. 275 volt, full automatic G.E. control, with transformers arranged for 2300, 4100, 6000, or 13200 volts.

SLIPRING MOTORS

HP	Make	Type	Volts	Speed
800	Wstg.	CW	6600/440	507
600	G.E.	IP	6600/2300	300
400	Al. Ch.	ANY	2300	514
300	G.E.	IM	2300	450
250	Al. Ch.		4000	900
250	Al. Ch.	ARY	220	705
60	Wstg.	CW	2300	870
50	G.E.	I	440	1720
50	L. Al.	GH	220/440	870
35	F. Mrse.	UAV	220	1800
35	Wstg.	CW	440	1200
35	G.E.	I	440	1140
30	Lincoln	FR	220	900
30	G.E.	I	440	1150
30	G.E.	MT	2200	1740
30	G.E.	ITC	440	1800

STEAM TURBINE

2500 KVA General Electric, 3 phase, 60 cycle, 2300 or 4160 volts, 3600 RPM, 165 lbs. condensing.

Write for our latest stock catalogue—No. 4805-1

CHICAGO ELECTRIC COMPANY

1320 W. CERMAK RD. *CANAL 2900* **CHICAGO 8, ILL.**

MOTORS • GENERATORS • TRANSFORMERS

MOTORS

3 PHASE—25 CYCLE—220 440 VOLTS

H.P.	Make	Type	Frame	RPM
50	Fairbanks Morse	H16B	Ball Bearing	750
75	Fairbanks Morse	H16	B.B. Slipring	750
5	Gen. Elect.	IK	2200 volt	750
75	Gen. Elect.	IK		1500
100	Allis Chalmers			1450
150	Gen. Elect.	IK-17		365
150	Gen. Elect.	IK-16		480
150	Gen. Elect.	IM-16	Slip Ring	480
150	Allis Chalmers			1450
150	Gen. Elect.	KT	557	1455
400	Gen. Elect.	IM 17A	Slip Ring	730
500	Gen. Elect.	IK		485
600	Gen. Elect.	MT	Slip Ring	490
600	Westinghouse	CS		490

TRANSFORMERS

3—667 KVA New Transformers—O.I.S.C. 13,800 Volts Primary, 480 Volts Secondary, 1 Phase 60 Cycle with Taps —for June 1 delivery.

TRANSFORMERS

3—150 KVA Niagara OISC 2400/120/240 1 Phase, 60 cycle with Taps.
3—150 KVA Niagara OISC 2400/240/480 1 Phase, 60 cycle with Taps.
6—100 KVA Niagara OISC 2400/240/480 1 Phase, 60 cycle with Taps.
3—100 KVA Niagara OISC 2400/120/240 1 Phase, 60 cycle with Taps.
3—75 KVA Niagara OISC 2400/240/480 1 Phase, 60 cycle with Taps.
3—50 KVA Niagara OISC 2400/240/480 1 Phase, 60 cycle with Taps.

FREQUENCY CHANGERS

All Sizes in Stock. 60 cycle to 90 cycle. 100 cycle, 120 cycle, 180 and any other high cycle if desired.

HORIZONTAL & DUPLEX
Compressors & Vacuum Pumps after Coolers, Filters

25 CYCLE MOTORS

1—1270 HP. Gen. Elect. Synchronous Motor Type A.T.I. 3/25/2200 Volts 150 RPM.
1—1900 HP. Gen. Elect. Synchronous Motor Type A.T.I. 3/25/2200 Volts 150 RPM.

MOTOR GENERATOR SETS

2—350 KW General Electric Sets 250 Volts D.C. driven by 500 HP. 3 Phase 25 Cycle motors.

ROTARY CONVERTER

1—2000 KW Westinghouse Booster type Rotary Converter 230 Volt D.C.—3 to 6 Phase, 25 Cycle, 4600 Volt Transformer.

300 HP. COMPENSATORS

2—300 HP. Gen. Elect. Reduced Voltage manually operated Type CR1034, 3 Phase, 60 cycle, 440 volts. Floor Type with undervoltage and overload protection.
1—300 HP. Gen. Elect. Reduced Voltage manually operated Type CR. 1034 K 22 3 Phase 60 cycle 440 volts.

NEW MOTORS

300 New Gen. Elect. & Westinghouse Motors in stock from 1 to 100 H.P.

MOTORS

1—75 HP. Fynn-Weischel Syn. 3/60/440/1200 RPM.
1—100 Gen. Elec. Slipring Type I Form M., 3/60/440/900 RPM.
1—100 HP. Gen. Elect. Type K (New Motor) 3/60/440/1800 RPM.
1—100 HP. Westinghouse Slipring Type CW, 3/60/440/435 RPM.
1—100 HP. Westinghouse Motor Type CS-867A. 3/60/440/885 RPM.
1—100 HP. West. Slipring Type CW 3/60/440/1200 RPM.
1—100 HP. Gen. Elect. Slipring 3/60/440/1200 RPM.
1—200 Gen. Elect. Type KT. 572 3/60/440/600 RPM.
1—200 HP. Gen. Elect. Slipring Type I Form M. 3/25/440/500 RPM.
1—500 HP. Allis Ch. Slipring 3/60/2200/514 RPM.
1—500 HP. Gen. Elect. Type I Form K, 3/25/440/485 RPM.
1—600 HP. West. Motor Type CS, 3/25/550/490 RPM.
1—600 HP. Gen. Elect. Slipring Type MT, 3/25/550/490 RPM.

VARIABLE SPEED MOTORS

2—300/150 HP. General Electric Motors Type BTA.—3 Phase 60 cycle 440 volts 560/280 RPM with controls

3 PHASE 550 VOLTS 25 CYCLE MOTORS
Write for our stock list of approximately 500—3/25/550 Voltmotors

ERIE ELECTRIC CO., INC.

124 CHURCH ST. BUFFALO, N. Y.
CL. 4758

SEARCHLIGHT SECTION

SLIP RING MOTORS
3-Ph., 60 Cy.

HP	Volts	Make	Speed
200	2200/440	G.E.	600
200	2200/440	G.E.	1200
200	440	G.E.	450
150	550	G.E.	720
150	2200/440	G.E.	1200
125	440/220	G.E.	600
125	440/220	G.E. (Hoist)	900
100	2200/550	G.E.	1800
100	440/220	G.E.	720
100	2200/440	G.E.	600
80	440/220	G.E. (MTC)	900
75	2200/550	G.E.	1800
75	2200/550	G.E.	900
50	440/220	G.E.	900

SYNCHRONOUS MOTORS
3-Ph., 60 Cy.

HP	Volts	Make	Type	RPM
400	440/220	G.E.	ATI	600
300	2200/440	G.E.	ATI	600
250	440/220	Whse.	HR	277
200	4150/2300	Whse.	G	1800
150	4150/2300	G	G	1800
120	440/220	G.E.	ATI	900
110	440/220	G.E.	TS	257
100	440/220	G.E.	TS	900
100	440/220/25 cy	G.E.	TS	375
100	440/220	Whse.	G	1800
75	440/220 (new)	Whse.	G	1800
75	2200/440	Whse.	GE	600

TURBO GENERATOR

Generator, 125 kva. 1200 rpm. 440/220 v., Whse., dir. conn. by reduction gear to Turbine, 100 kw, 7380 rpm. non-condensing, 150-200 lbs. ga. pr. complete with dir. conn. exciter and switchboard; practically new condition, never used.

AIR COMPRESSOR UNIT

1—13" and 8" by 10" Worthington FEATHER-VALVE, 285 rpm, 110 lbs. ga., motor-driven, complete.

CIRCUIT BREAKERS

1—5000 amp., ITE, 3 pole, 600 v., air
1—4000 amp., ITE, 3 pole, 600 v., air
2—2000 amp., G E, 3 pole, 600 v., air
2—1600 amp., ITE, 3 pole, 600 v., air

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
600	2300/440	G.E.	KT	1200
500	440/220	G.E.	IK	900
400	550	G.E.	IK	720
350	2200/440	Whse.	CS	600
300	2200/440	Whse.	CS	600
200	440/220	G.E.	TEFC	1800
200	2200/440	G.E.	KF	720
200	2200/550	Cr. Wh.	SC	900
200	2200/440	G.E.	KT	1200
150	440/220	Howell	B. Brg.	1800
150 vert.	440/220	G.E.	KTP	1200
125 vert.	440/220	G E.	KTP	1200
125	440	G.E.	KT	600
100	440/220	G.E.	KT	450
100	2200/440	G.E.	K	1200
100	2200/550	G.E.	KT	900
75	440	G.E.	KT	400
60	440/220 (new)	L. Allis	OGA	1800

A. C. GENERATORS

1—320 kva., 600 rpm., 440/220 v., G.E.
1—300 kva., 600 rpm., 2200/440 v., G.E.
1—150 kva., 1800 rpm., 2200/550 v., Whse.
1—112 kva., 900 rpm., 440/220 v., G.E.
1— 98 kva., 1800 rpm., 440/220 v., G.E.
2— 75 kva., 1800 rpm., 440/220 v., Whse.
1—62½ kva., 1200 rpm., 440/220 v., Whse.

D. C. MOTORS

HP	Volts	Make	Type	Speed
200	230	Cr. Wh.	CMC	890
150	230 (new)	Cr. Wh.	TEFC	900
100	230	Cr. Wh.	CMC	625
100	230	G.E.	CD	1750
75	230 (new)	Whse.	SK	1150
75	230	Whse.	SK	850
75	230	Whse.	SK	1750

MOTOR GENERATOR SETS

1—250 kw., 250 v., 1200 rpm., Cr. Wh., conn. to 300 kva., 400/2300 v., 3 ph., syn. motor.
1—150 kw., 250 v., 1200 rpm., conn. to 250 hp., 440/220 v., 3 ph., sq. cage Whse. motor.
1—100 kw., 250 v., 900 rpm., Cr. Wh., conn. to 150 hp., 440/220 v., sq. cage.
1—75 kw., 125 v., 1200 rpm., G.E., conn. to 120 hp., 2250/440 v., syn. motor.
1—75 kw., 250 v., 1200 rpm., Whse., conn. to 112 hp., 440/220 v., sq. cage motor.
1—50 kw., 250 1200 rpm., G.E., conn. to 75 hp., 440/220 440/220 v., 60 cy., G.E. syn. motor.
1—50 kw., 250/1200 rpm., G.E., conn. to 75 hp., 440/220 v., 60 cy., syn. motor.

TRANSFOMERS
60 Cycle

1—1000 kva., Al. Chal., 2400-120/240/208 volts, 3 phase. NEW.
1—500 kva., G.E., 2400/4150Y-240 v., 3 ph., unused.
1—400 kva., G.E., 2300-230/115 v.
3—200 kva., Whse., 7200/12400Y-240/480 v., 1 ph.
3—200 kva., G.E. 4800/2400-120/240 v., 1 ph.
1—150 kva., Whse., SK, 13200-125/215 v., 3 ph.
6—100 kva., G.E., 4600/2300-230/115. NEW.
3—100 kva., G.E., 450-115/230 v., dry, 1 ph., new.
3—37½ kva., Whse., 440-115 v., dry, 1 ph.

STEPHEN HALL & CO.

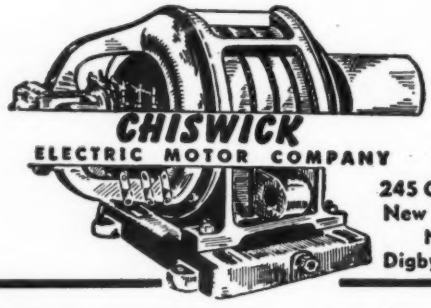
HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

MOTORS • CONTROLS • GENERATORS

Rebuilt Guaranteed Equipment in Stock

SIZES FROM 1 HP TO 250 HP



CHISWICK
ELECTRIC MOTOR COMPANY

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SURPLUS ELECTRICAL EQUIPMENT

2—2100 HP, GE Synchronous motors, 514 RPM, 4600/2300 V, 3 phase, 60 cycle. 80% P.F. Complete with rheostats and belted exciters. Full details on application
2—2000 KVA Transformers—Single phase, 60 cycle, 69/34.5 KV to 4800/2400 V. Westinghouse O.I.S.C.
1—3500 KVA—3 phase, 60 cycle, 33/13.8 KV Westinghouse Transformer.
1—600 A., 3 P.S.T., 34.5 KV Outdoor O.C.B. Westinghouse CO-1-A.
1—3 pole, 600 A, 34.5 KV Outdoor Disconnect Switch.
Miscellaneous Distribution Transformers, Cable, Switches, Potheads and Electrical Instruments. Also Ross Carrier—hardly used. Arch measurements—91" high and 76" wide. 7 Ton capacity.
All the above are for immediate sale and are located at our Pulp Mill on Vancouver Island.

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904 Standard Building. Vancouver, B. C.

THREE WIRE D.C. GENERATORS

1—500 KW Whse reduction gear turbo-generator unit, type 6 EHNC, non-condensing, compound interpole, good commutator 125/250 V.
1—750 KW Whse generator only, single bearing, 550 RPM, compound interpole, 125/250 V. Splendid condition.

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BOX 566 DALTON, PA.

GOOD USED MOTORS
EXCELLENT CONDITION

Western Electric—A.C., Type KT, Series 100 3 Phase, 220 volts, 60 cycles.
250 2 H.P. 1200 R.P.M.—100 3 H.P. 900 R.P.M.—30 5 H.P. 1800 R.P.M.
Also Miscellaneous Motors in Various Speeds and Phases.
300 New Cutler-Hammer CH DC Motor Controls—230 Volts, 2.75 H.P.
100 Used Cutler-Hammer CH A.C. Motor Controls 110 Volts, 25-30 Cycles or 220 Volts 50-60 Cycles.

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214-222 HAMILTON STREET • ALLENTOWN, PA.

FOR SALE

(1)—25 HP, Triumph Elec. Co., C12, 2200 v, 60 cy, 3 ph, 1150 rpm, cont. rated, wound rotor bare motor. Reconditioned.
(2)—30 HP, Continental, 230 v, DC, 650 rpm, totally enclosed, fan cooled, ball bearing.
(1)—3 HP, GE, MT948, 3/60/550/1800. Like new.
(1)—7½ HP, GE, MTC5946, 3/60/220/440/1200. Like new.
(1)—120 HP, GE, MTC, 3/60/220/440/690. Rewound.
(1)—50 HP, West. CS, 3/60/220/440/900. Class 2, bb.
(3)—25 HP, West. CS, 3/60/220/440/900. Class 2, bb.
(1)—75 HP, West. CS, 3/60/220/440/1200 gen. purpose.
Many other items available. Send me your inquiries.

E. P. DIETRICK
829 Richmont St. Scranton 9, Pa.

SALE

NEW 5000-KVA. G.E., 600#-psi., 750°FTT. Turbine-Generator, Automatic Extraction at 150#, Non-condensing @ 25#. The only New 600#, 5000-KVA immediately available in the past 5 years. Also NEW 1075-KVA. G.E., 450# psi.
Offered subject to Prior Sale: Wire or Phone

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TRANSFORMERS

1 KVA up to 200 KVA in stock

ARROW TRANSFORMER CO., INC.
1932 E. Westmoreland St., Phila 34, Pa.
Phone Ga. 5-0488

SYNCH. CONVERTERS

300 KW G.E. 250 D.C. 1200 RPM. 6 PH. 60 CY 2300/4000 V. TRANSFORMERS.

300 KW G.E. 600 D.C. 1200 RPM. 6 PH. 60 CY. 2300/4000 V. TRANSFORMERS.

MOTOR GENERATORS

500 KW G.E. SYN 250 V. 2300/4000 A.C. 900 RPM. 3 PH. 60 CY.

500 KW G.E. SYN. 600 V. 2300/4000 A.C. 900 RPM. 3 HP. 60 CY.

400 KW WEST. SYN. 600 V. 2300/4000 A.C. 720 RPM. 3 PH. 60 CY.

400 KW G.E. SYN. 250 V. 2300/4000 A.C. 900 RPM. 3 PH. 60 CY.

300 KW G.E. SYN. 250 V. 2300/4000/440 A.C. 720 RPM. 3 PH. 60 CY.

250 KW G.E. SYN. 125/250 V 2300/4000 A.C. 720 RPM. 3 PH. 60 CY.

Each unit listed above is owned by us and is available now for immediate purchase.

WALLACE E. KIRK COMPANY
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TRANSFORMERS, TURBINES, MOTOR GENERATOR SETS, ROTARY CONVERTERS, BOILERS, CIRCUIT BREAKERS, MOTORS, ENGINE GENERATING UNITS.

We buy and sell Electrical and Steam Machinery. Send us data as to your requirements; also send us description of equipment you have for sale.

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FOR SALE

McIntosh & Seymour Tandem Compound Engine No. 1540. 16" diameter high pressure—33" diameter low pressure, 38" stroke, 130 R.P.M., rated 500 h.p. Has with it Twin Beam Vertical Marine Jet Condensor Pump 10 x 15 x 22.

CRANE & CO., INC., Dalton, Mass.

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COMPLETE 2500 KW STEAM POWER PLANT

consisting of two, 1250 KW 3-phase 60-cycle, 2300-volt, Allis-Chalmers turbo-generators with control panels, condenser, boilers, economizers, super-heaters, feed water regulators, pumps, piping, induced-draft fan, direct firing coal pulverizers with bin and stand-by fuel oil burning equipment. All equipment complete with motors and controls where required. In excellent condition and now available.

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111 W. Monroe St. Chicago 3, Ill.

ELECTRICAL EQUIPMENT — REBUILT and GUARANTEED

MOTORS—GENERATORS—MG SETS—TRANSFORMERS—CONTROLS

LARGE STOCK OF A.C. and D.C. MOTORS!

SLIP RING MOTORS—3 Ph., 60 Cy.

Qn.	H.P.	Speed	Volts	Make	Type
6	7½	810	550	G.E.	MTC-5201
1	7½	575	220	G.E.	MT-522
2	10	1149	440	West.	HF-7A
2	10	570	220	G.E.	HI-11
2	11‡	810	550	G.E.	ITC-5008
2	15	1160	440	West.	CW-464C
2	15	570	220	West.	CW-646
1	18	680	440	West.	MW-316
1	20	860	440	West.	CW-638
1	25	1130	550	G.E.	MT-323
2	25	850	220	Wagner	BR
2	25	720	440	Wagner	22VBR
1	30	865	440	West.	CW-646
1	30	850	440	G.E.	MT-332
1	30	675	440	G.E.	MT-336
2	35	600	440	F-M	HV-H16A
2	40	865	2200	Al.-Ch.	ARY-223C
1	40	560	440	G.E.	MT-346
2	50	1150	440	G.E.	M-536
1	50	869	440	West.	HF-12A
5	52‡	550	220	G.E.	IQC-5013***
1	60	685	440	West.	CW-758
1	60	570	550	G.E.	MTC-5546
1	60	345	550	West.	CW
1	75	720	550	G.E.	MT-556
1	80‡	575	440	G.E.	MTC-5352
2	125	430	440	G.E.	IL-16
2	150	1750	440	G.E.	MTP-549
1	150	870	440	G.E.	MT-561
1	175	505	550	West.	CW-1002
2	200	600	550	G.E.	IM-17
1	200	495	2200	G.E.	IM-17A
3	250**	296	220 380††	West.	CW-20-53-15
3	300	900	140	G.E.	IM-17
2	300	880	2200	G.E.	IM-17A
1	300	514	550	G.E.	IM-17A
3	300**	360	440	West.	CW-20-53-15
2	350	880	2200	G.E.	IM-17A
1	400	505	550	West.	CW
1	700	720	2300/4000	West.	CW

All 220 volt motors can be reconnected for 440 volts and vice versa.
‡ Intermittent rating. *** 2 phase.
** New. †† 50 Cycle.

230 Volt Constant Speed D. C. Motors

Qn.	H.P.	Speed	Make	Type
22	2	850	West.	SK-20
20	3	1150	West.	SK-20
10	3	850	Reliance	Y-23T
25	3½	850	West.	SK-30
3	7½	1750/1310	West.	SK-43
2	7½	1150	G.E.	CDM-66
2	7½	875/1750	West.	SK-631
3	7½	850	G.E.	CD-75
10	10**	1750	Kimble	BA-324
5	10**	1150	Al.-Ch.	EB-86
1	10	850	West.	SK-83
10	13½**	600	West.	SK-93
5	15	825	West.	SK-90
1	20	1750/1310	West.	SK-83
2	20	1150	G.E.	RC-30
11	20	750	West.	SK-1101
17	25	825	West.	SK-120
1	30	750	G.E.	RC
1	40	1700	West.	SK-103
1	40	750	G.E.	RC-34
1	50	750	West.	SK-150
1	50	650	G.E.	RC-16
2	60	1750/1310	West.	SK-143
3	75	850	West.	SK-160
1	150	700	Al.-Ch.	
2	200	1150	G.E.	RC-38
1	250	1150	C.W.	CMC-101A

230 VOLT ADJ. SPEED D.C. MOTORS

Qn.	H.P.	Speed	Make	Type
10	1½	500/200	G.E.	CD-65
1	2	225/900	Reliance	78T
1	5	450/1800	G.E.	CD-83
2	6	450/1800	G.E.	RF-9
6	5/7½	600/1800	G.E.	RA-30
5	10	400/1600	Reliance	T-92T
1	12½	280/840	West.	SK-130
10	12½**	600	West.	SK-93
1	15	600/1200	West.	SK-100L
1	20	500/1500	G.E.	RF-11
1	20/25	300/1200	West.	SK-153
1	25	500/1500	G.E.	RF-12
1	23/29	300/1200	G.E.	RF-13
1	30	400/1200	West.	SK-163
1	36/40**	400/1600	G.E.	CD-1236
1	35	500/1500	West.	SK-143
1	40/50	400/1600	Al.-Ch.	EB-147
1	75	500/1500	Cr.-Wh.	CCM
1	75	375/750	Cr.-Wh.	CMC-125H
3	100	225/900	G.E.	MPC-A
5	100	400/1200	Al.-Ch.	
1	100	320/960	West.	SK-200
1	175	230/750	West.	SK-220
2	375	350/500	G.E.	MPC

** New.

VARIABLE VOLTAGE DRIVES

40 HP. Reliance, Variable Voltage Drives, each Consisting of:
1—40 KW. 250 Volt, Induction M-G Set, with two auxiliary 5 KW generators and exciter.
1—40 HP. 400/1500 RPM. Frame 385T, 230 Volt, DC Motor.
With full magnetic control providing jog forward, jog reverse, run, fast, slow, and stop, and motor operated field rheostat.

SQUIRREL CAGE MOTORS—3 Ph., 60 Cy.

Totally Enclosed Fan Cooled, Ball Bearing

Qn.	H.P.	RPM	Volts	Make	Type & Frame
2	½	1750	220	R&M(TE)	L-184
1	½	1725	440	G.E.	K-83
4	1	1140	220	Howell	A-204
4	1.5	1150	220	L.A. (TE)	IS-225
5	1.5	1140	440	West.	CS-225
1	2	1735	220	G.E.	K-224
4	2	1140	220	L.A.	JS-225Y
1	2	1100	440	West.	CS-225
1	3	3450	220	Howell	K-224
3	3	1160	440	L.A.	JS-254
1	5	3480	220	G.E.	K-225
2	5	1750	440	L.A.	JA-254
12	5	1730	440	G.E.	K-254
1	5	1720	440	Century	SCH-254
2	5	1165	440	L.A.	JA-284
5	7.5	1740	440	G.E.	K-284
1	7.5	1735	220	G.E.	KF-284
1	10	3480	440	West.	CS-324
1	10	1140	440	Wagner	CP2-326
1	10**	880	220	West.	CS-365-EXPF
1	15	1745	440	West.	CS-326
1	15	1175	440	L.A.	JA-365
1	25	1170	220	L.A.	JX-405
1	25	705	440	West.	CS-W504

Splashproof, Ball Bearing

1	2	1735	440	G.E.	K-224
1	3	1160	440	L.A.	FS-254
23	5	1750	440	L.A.	FS-254
1	5	1735	220	G.E.	K-254
1	5	1160	440	L.A.	FX-284
1	10	3480	440	G.E.	K-284
1	15	1175	440	L.A.	JA-365
4	15	1150	440	L.A.	FX-365
3	30	3520	440	L.A.	FX-365S
3	40	1175	220	G.E.	K-445
3	50	1760	440	L.A.	FX-445A
5	50	1160	220	G.E.	K-504
1	75	870	440	West.	CS-752-C
1	125	1770	440	L.A.	FX-1078Y
1	150	1775	440	L.A.	FX-1168
4	150	880	440	L.A.	FX-1368
1	150	700	440	G.E.	K-6335
1	200	885	440	L.A.	FS-1378

Open Type Motors

Qn.	H.P.	Speed	Volts	Make	Type
5	2	170	440	G.E.	KT-926
4	2	1160	440	West.	CS-93C
1	2	690	440	G.E.	KT-944
10	5	1740	440	West.	CS-232C
1	7½	3475	440	West.	CS
1	7½	1750	440	West.	CS-250C
3	7½	1165	440	G.E.	KT-952
2	7½	870	440	West.	CS-370C
5	10**	1760	440	L.A.	OGA-324
5	10**	1750	440	West.	CSP-324
3	10	1160	440	West.	CS-370C
1	10	865	440	G.E.	KT-502
1	15	3485	220	Reliance	AA-B3247
5	15**	1735	440	Century	SC-326
1	15	1200	220	G.E.	KT-502
1	15	900	220	G.E.	FTR-512
1	20**	3475	220	West.	CS-326
5	20**	1750	440	Wagner	RP1-364
1	20	1750	220	West.	CS-W364
1	20	1200	220	G.E.	KT-512
2	20	900	220	G.E.	FTR-522
1	25	1800	220	G.E.	KT-312
5	25**	1740	440	Century	SC-364
1	25	1160	440	West.	CS-667C
1	25	900	220	Howell	SCRB-356***
2	25	575	440	G.E.	KT-542
1	30	1160	440	West.	CS-644
1	30	870	220	West.	CS-646
1	40**	3545	220	G.E.	KF-404S
3	40	1750	440	West.	CS-583C
2	40	900	2300	G.E.	FTR-536
4	50**	1750	440	Wagner	RP5-405
1	50	850	220	West.	CCL
2	60**	1750	440	Ideal	AH-444
2	60	900	440	G.E.	KT-346
1	75	1160	440	West.	CS-662C
1	75	870	220	West.	CS-766A
1	100	690	220	West.	C
1	100	580	2200	G.E.	UK-15A
2	100	500	2200	West.	CS-930
1	100	495	2200	Al.-Ch.	AN
2	125	425	440	Al.-Ch.	AR
2	125	400	2300	G.E.	I-17-FR
2	200	580	550‡‡	G.E.	KT-566S
1	500	1200	440	G.E.	KTP-567
1	700	1800	2300/4000	West.	CS-4-39D-12

All 220 volt motors can be reconnected for 440 volts and vice versa.
** New. *** 2 Phase.
‡‡ Reconnectable for 440 volts.

CRANE, MILL TYPE 230 V. D.C. MOTORS

Qn.	H.P.	Speed	Make	Type
2 (115 v.)	3½	700	G.E.	CO-1803
2	5½	760	West.	MCB-20
1 (new)	10	650	G.E.	MD-403-BE
3	25	590	Diehl	TE
2	35	750	G.E.	CO-1828
3 (new)	35	600	West.	CK-9
1	50*	750	G.E.	CO-1829A
1	50	600	West.	CK-9
5 (new)	50	525	G.E.	COM-1830AE
1	59	470	G.E.	CO-2007
2 (new)	60	550	G.E.	COM-1831AE
4	65	450	G.E.	COM-1830

Above Items Represent a Partial Listing Only. Your Inquiries Will Receive Our Prompt Attention. All Equipment Is Located In Our Cleveland Warehouse. We Have Controls for Most Items Listed.

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Rebuilt and Sold with a Standard New Guarantee

IND. FREQUENCY CHANGERS SETS

MOTOR GENERATOR SETS
ALTERNATORS ALL FREQUENCIES
TRANSFORMERS LARGE STOCK
D.C. GENERATORS ALL VOLTAGES
CONTROL EQUIPMENT

ALL SIZES, VOLTAGE AND CYCLES

3 ph. 60 cy. A.C. Motors
3 ph. 25 cy. Motors
125 Volts D.C. Motors
230 Volt D.C. Motors
550 Volt D.C. Motors

WRITE OR WIRE YOUR INQUIRIES

BERGER BROTHERS Electric Motors, Inc., 395 STATE ST., ROCHESTER 4, NEW YORK

PUT ALL IDLE EQUIPMENT TO WORK. SEND YOUR LIST FOR PROMPT ACTION.

TURBO GENERATORS

1--500 K.W., 3 phase, 60 cycle, General Electric non-condensing.
500 KW., 3 phase, 60 cycle, 440 volt Gen. Elec. #39937 with surface condenser, evactor, and switchboard.
750 KW. Gen. Elec., 150 lbs. steam, 10-20 lbs. extraction.

MOTOR GENERATORS

300 KW., 250 volt Gen. Elec. to a 435 HP., 3 phase synch. motor with boards.
100 KW., 125 volt Gen. Elec. to a 150 HP., 3 phase motor.
80 KW., 80 volt Burke with synch. motor and panels.
50 KW., 250 volt Westgh. to 3 phase synch. motor.

TRANSFORMERS

1—750 KW. Westgh. 13800 x 80 down to 60 volts.
2—150 KVA. Pittsburgh 2300 x 230/460 volt.
2—150 KVA. Pittsburgh 2400 x 120-240 volt.
4—100 KVA. Westgh. 13200 x 2200 volt.
3—100 KVA. Westgh. 13800 x 230/460 volt.
Over 100 NEW Gen. Elec. up to 75 KVA., 450 x 120 volt.

DC ENGINE GENERATOR

150 KW., 125 volt Crocker Wheeler to a 4 cylinder vertical Ames engine.

MOTORS

Large stock AC & DC motors

CAPACITORS

50—15 KVA, 220 volt, 3 phase, new, General Electric

All above equipment actually in stock. Send for our list of many other items we have.

KEYSTONE
Power Plant Equipment Company

8403 Hegerman St. Phila. 36, Pa.

HEADQUARTERS for GEARMOTORS

Brand New G.E. and U.S. 3 Phase 60 Cycle 220/440 Gearmotors in Stock

Guaranteed for One Year

5—	½ HP 100 rpm	3— 3	HP 350 rpm
10—	¾ HP 100 rpm	1— 5	HP 68 rpm
9— 1	HP 84 rpm	3— 5	HP 100 rpm
5— 1	HP 230 rpm	10— 5	HP 230 rpm
5— 1½	HP 68 rpm	2— 7½	HP 100 rpm
15— 1½	HP 280 rpm	5— 7½	HP 420 rpm
8— 2	HP 37 rpm	2—10	HP 100 rpm
6— 2	HP 230 rpm	4—10	HP 280 rpm
7— 3	HP 45 rpm	1—15	HP 84 rpm
4— 3	HP 280 rpm	4—15	HP 350 rpm

Also New Speed Reducers from ½ HP to 20 HP and Rebuilt Gearmotors from ¼ HP to 25 HP in Stock at All Times

Ask for price list

Prompt Detailed Replies to All Inquiries

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NEW ENGLAND'S LEADING MOTOR DEALER
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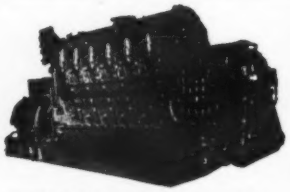

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Generator Plants
For Immediate Delivery

HEMCO

1000 KW, 2400 Volts, 3 Phase, 60 Cycle, 720 RPM, General Motors Model 16-278A
750 KW, 2400 Volts, 3 Phase, 60 Cycle, 720 RPM, General Motors Model 12-567
600 KW, 2400 Volts, 3 Phase, 50 Cycle, 600 RPM, General Motors Model 12-567
300 KW, 450/2400 Volts, 3 Phase, 60 Cycle, 1200 RPM, General Motors Model 8-268A
200 KW, 450/2400 Volts, 3 Phase, 60 Cycle, 1200 RPM, General Motors Model 8-268A
125 KW, 220/440/2400 V, 3 Ph, 60 Cy, 1200 RPM, General Motors Model 3-268A
125 to 900 HP Diesel Driven Right Angle Pump Drive Units 900 to 1800 RPM.
75 KW, 220/440 Volts, 3 Phase, 60 Cycle, 1200 RPM, Hercules Diesel DFXE
50 KW, 440 Volts, 3 Phase, 60 Cycle, 900 RPM, Fairbanks-Morse Model 36A 5½
100 KW, 3 Wire, 125/250 Volts DC, 1200 RPM, General Motors Model 3-268A
900 HP, General Motors Model 12-567, Propulsion Unit Complete

HERCULES ELECTRIC MACHINERY and EQUIPMENT CO.
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Cable Address HEMCOY Los Angeles 34, Calif.

POWER PLANT

2—400 KW G.E. 250 V. DC Generators to:
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2—510 HP B&W Sterling Boilers, 160# with stokers, fittings. All new in 1930.

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ADVERTISERS' INDEX

Where an * appears after a name the advertisement does not appear in this issue, but appeared in preceding issues

Air Preheater Corp. ..... *
Air Express Div., Railway Express Agency 140
Allen-Sherman-Hoff Co. ..... Second Cover
Allis-Chalmers Mfg. Co. 35, 50
Alloy Steel Products Co. ..... *
Allpax Co. 176
American Blower Co. 218
American Brass Co. 119
American Chain & Cable Co. 189
American District Steam Co. 170
American Engineering Co. ..... *
American Locomotive Co. ..... *
American Manganese Steel Div. ..... *
American-Marietta Co., Valdura Div. 215
American Pulverizer Co. 57
Anchor Packing Co. 197
Anderson Co., V. D. ..... *
Arco Co. ..... *
Arkansas Fuel Oil Co. 157
Armstrong Cork Co. 222
Armstrong Machine Works 137
Associated Research, Inc. ..... *
Atlas Valve Co. 182
Aurora Pump Co. 158
Automatic Control Co. ..... *

Babbitt Steam Specialty Co. 176
Babcock & Wilcox Co. 4-5
Badger & Sons Co., E. B. 186
Bailey Meter Co. 12-13
Baldwin-Hill Co. ..... *
Bartlett Hayward Div., Koppers Co. ..... *
Bartlett & Snow Co., C. O. 243
Beaumont Birch Co. ..... *
Bell & Gossett Co. 241
Belmont Packing Co. ..... *
Betz Co., W. H. & L. D. 117
Biddle & Co., James G. ..... *
Birch Mfg. Co. ..... *
Bird-Archer Co. 223
Black, Sivalls & Bryson Co. 146A
Blaw-Knox Co. ..... *
Boiler Tube Co. of America 242
Boston Woven Hose & Rubber Co. ..... *
Bridgeport Brass Co. 227
Bros Boiler & Mfg. Co. 179
Brown Instrument Co. ..... *
Buell Engineering Co. 146
Buffalo Forge Co. 233
Buffalo Pumps, Inc. 56
Bussmann Mfg. Co. ..... *
Byers Co., A. M. 62

Carborundum Co. ..... *
Cardox Corp. ..... *
Carey Mfg. Co., Philip ..... *
Cash Co., A. W. 48
Catawissa Valve & Fittings Co. 180
Chapman Valve Mfg. Co. 145
Chase Brass & Copper Co. 149
Chicago Metal Hose Corp. 245
Chicago Pneumatic Tool Co. ..... *
Cities Service Oil Co. 157
Clarage Fan Co. 216
Clark Mfg. Co. ..... *
Cleaver-Brooks Co. 198
Cochrane Corp. 217
Coffin Jr. Co., J. S. 141
Combustion Engineering Co. 16-17
Coppus Engineering Co. ..... *
Corning Glass Works ..... *
Crane Co. 123
Crane Packing Co. 194
Cryer Trap & Valve Co. ..... *

Dampney Co. of America ..... *
Darling Valve & Mfg. Co. ..... *
Dart Mfg. Co., E. M. 142
Davis Engineering Co. ..... *
Davis Regulator Co. ..... *
Dearborn Chemical Co. 203
DeLaval Separator Co. 195
DeLaval Steam Turbine Co. 58, 166
Detroit Stoker Co. 36-37
Diamond Power Specialty Co. 8-9
Dings Magnetic Separator Co. ..... *
Dodge Mfg. Corp. 188
Dowell, Inc. ..... *
Dravo Corp. 135, 166, 168
Drew Co., E. F. ..... *
Dudgeon, Inc., Richard ..... *
Dutton Co., C. H. 146B

Eagle-Picher Co. 190
Edward Valves, Inc. 111
Electric Machinery Mfg. Co. 177
Electric Storage Battery Co. 209
Elgin Softner Corp. ..... *
Elliott Co. 6-7
Engineer Co. 175
Erie City Iron Works 234

Fairfield Engineering Co. ..... *
Fairmont Coal Bureau 192
Filtrol Corp. 240
Flader, Inc., Fredric 156
Flynn & Emrich Co. 224
Foster Engineering Co. ..... *
Foster Wheeler Corp. 20-21
Foxboro Co. 196
Frederick Iron & Steel Co. ..... *
Frick Co. 158
Fuller Co. 152

Garlock Packing Co. 212
General Coal Co. 160
General Controls Co. 236
General Electric Co., (Apparatus Dept.) 26-27
Gifford-Wood Co. ..... *
Globe Steel Tubes Co. 191
Golden-Anderson Valve Spec. Co. 153
Goodyear Tire & Rubber Co. ..... *
Goulds Pumps, Inc. 181
Grinnell Co. ..... 45, 169, 3rd Cover
Griscom-Russell Co. 32
Gulf Oil Corp. 219
Gulf Refining Co. 219
Gunite Concrete & Construction Co. 168

Haering & Co., D. W. ..... *
Hagan Corp. 24-25
Hall Laboratories ..... *
Harbison-Walker Refractories Co. ..... *
Haynes Stellite Co. 159
Hays Corp. ..... *
Hays Institute of Combustion ..... *
Heacon, Inc. ..... *
Hendrick Mfg. Co. ..... *
Henszey Co. 164
Hewitt Rubber Div., Hewitt-Robins, Inc. 221
Heyl & Patterson, Inc. ..... *
Hill Pump Valve Co. ..... *
Hoffman Specialty Co. ..... *
Homestead Valve & Mfg. Co. ..... *
Honan-Crane Corp. ..... *
Hoppes Mfg. Co. 236

Illinois Water Treatment Co. 150
Infilco, Inc. ..... *
Ingersoll-Rand Co. 185
International Nickel Co. 55
Iron Fireman Mfg. Co. ..... *

Jefferson Union Co. 182
Jeffrey Mfg. Co. 217
Jenkins Bros. 128-129
Jerguson Gage & Valve Co. 138
Johns-Manville, Inc. 133
Jones Foundry & Machine Co., W. A. ..... *
Joy Mfg. Co. (Sullivan Div.) 226

Keasbey & Mattison Co. 235
Kellogg Co., M. W. 171
Kennedy Valve & Mfg. Co. 214
Kennedy-Van Saun Mfg. & Engrg. Corp. 22-23
Kewanee Boiler Corp. 180
Koppers Co. ..... *

Ladish Corp. ..... *
Laminated Shim Co. ..... *
Leeds & Northrup Co. ..... *
Leibfried Corp., C. H. 210
Lincoln Electric Co. ..... *
Link-Belt Co. 3
Liquid Conditioning Corp. 187
Liquidometer Corp. ..... *
Lovejoy Flexible Coupling Co. 176
Lummus Co. 228
Lumnite Div. Universal Atlas Cement Co. 204
Lunkenheimer Co. 30-31

Madden Co., P. E. 168
Manheim Mfg. & Belting Co. 206
Manning, Maxwell & Moore, Inc. 242
Marley Co. ..... *
March Corp., James P. ..... *
Mason-Neilan Regulator Co. ..... *
Maxim Silencer Co. 236
McGraw-Hill Book Co. 238
Mercoid Corp. ..... *
Midwest Piping & Supply Co. 205
Minneapolis-Honeywell Reg. Co. ..... *
Mitchell & Co., W. K. 165
Modine Mfg. Co. ..... *
Monsanto Chemical Co. ..... *
Murray Iron Works Co. 154

National Aluminate Corp. . . . 127
National Electric Coil Co. . . . *
National Tube Co. . . . *
National Valve & Mfg. Co. . . . 28
Niagara Blower Co. . . . *
Nicholson Co., W. H. . . . 166
Nordberg Mfg. Co. . . . 237
Northern Equipment Co. . . . 131
Norton Co. . . . *
Nugent & Co., Inc., W. W. . . . *

Ofcco Construction Co., Inc. . . . 199
Ohio Coal Association . . . *
Ohio Injector Co. . . . *

Pacific Pumps, Inc. . . . *
Peabody Engineering Co. . . . *
Peerless Pump Div. . . . 162
Pennsylvania Crusher Co. . . . *
Penn. Flexible Metallic Tubing Co. . . . *
Permutit Co. . . . 143
Philadelphia Gear Works . . . 155
Pipe Fabrication Institute . . . 163
Pittsburgh Piping & Equipment Co. . . . 230
Powell Co., Wm. . . . 52-53
Prat-Daniel Corp. . . . *
Preferred Utilities Mfg. Co. . . . 54
Pritchard & Co., J. F. . . . *

Quaker Rubber Co. . . . *

Raybestos-Manhattan, Inc. Asbestos Textile & Packing Div. . . . 202
Reading, Prat & Cady Div. . . . 189
Reliance Gauge Column Co. . . . 34
Republic Flow Meters Co. . . . 38-39
Republic Rubber Div., Lee Tire & Rubber Co. . . . *
Republic Steel Corp. . . . 42–43
Research Corp. . . . 200
Revere Copper & Brass, Inc. . . . 125
Richardson Scale Co. . . . *
Ric-Wil Co. . . . 229
Riley Stoker Corp. . . . 96-97
Robins Conveyors Div. Hewitt Robins, Inc. . . . 221
Rockbestos Products Corp. . . . 44
Roto Div. of Elliot Co. . . . *
Roy Co., Milton . . . *

Sarco Co. . . . 207
Schramm, Inc. . . . 144
Schutte & Koerting Co. . . . 121
Shaw Co., B. F. . . . 201
Sier-Bath Gear & Pump Co. . . . *
Simplex Valve & Meter Co. . . . *
Sinclair Refining Co. . . . *
Skinner Engine Co. . . . *
Smith Refractories, Sanford C. . . . 246
Socony-Vacuum Oil Co. . . . 139
Springfield Boiler Co. . . . 29
Standard Oil Co. of Calif. . . . 167
Standard Oil Co. of Indiana . . . 14-15
Steel & Tubes Div. . . . 42-43
Stephens-Adamson Mfg. Co. . . . 51
Stickle Steam Specialties Co. . . . *
Stock Engineering Co. . . . 148
Stone & Webster Engineering Co. . . . 208
Strong, Carlisle & Hammond Co. . . . *
Strong-Scott Mfg. Co. . . . 49
Sturtevant Div., Westinghouse Electric Corp. . . . *
Sun Oil Co. . . . 115
Superior Combustion Industries . . . 182
Swartwout Co. . . . 274
Sweet's Catalog Service . . . 238
Syntron Co. . . . *

Taylor Forge & Pipe Works . . . 47
Taylor Instrument Co's . . . *
Terry Steam Turbine Co. . . . 193
Texas Co. . . . Back Cover
Thermix Corp. . . . *
Tidewater Associated Oil Co. . . . 213
Timken Roller Bearing Co. . . . 211
Todd Shipyards Corp., Combustion Equipment Div. . . . *
Troy Engine & Machine Co. . . . *
Tube-Turns, Inc. . . . 239

Union Carbide & Carbon Corp. . . . 159
Union Chain & Mfg. Co. . . . 183
Union Iron Works . . . 173
U. S. Steel Corp. . . . *

Viking Pump Co. . . . *
Vogt Machine Co., Henry . . . 161

Wallace & Tiernan Products, Inc. . . . 147
Walworth Co. . . . 220
Warren Steam Pump Co. . . . *
Watson-Stillman Co. . . . 225
Western Chemical Co. . . . *
Westinghouse Electric Corp. . . . 10-11, 40-41, 60–61
Weston Electrical Instrument Co. . . . 172
Wheeler Mfg. Co., C. H. . . . 151
Where to Buy . . . 246
Wickes Boiler Co. . . . 231
Wiedeke Co., Gustav . . . *
Williams Gauge Co. . . . 162
Wilson, Inc., Thomas C. . . . *
Wing Mfg. Co., L. J. . . . *
Worthington Pump & Machy Corp. . . . 46
Wrigley Jr. Co., Wm. . . . *

Yarnall-Waring Co. . . . 18–19, 113, 174
Youngstown Sheet & Tube Co. . . . 33

Zallea Bros. & Johnson . . . 178

PROFESSIONAL SERVICES **246**

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT
Positions Vacant . . . 248
Selling Opportunities Offered . . . 248
Positions Wanted . . . 248
Employment Services . . . 248

NOTICES
Auction . . . 248

EQUIPMENT
(Used or Surplus New)
For Sale . . . 249-271

WANTED
Equipment . . . 270

ADVERTISERS INDEX

A-C Supply Co. . . . 271
Aljon Diesel Co., Inc. . . . 271
American Air Compressor Corp. . . . 270
Archer & Baldwin Inc. . . . 265
Arrow Transformer Corp. . . . 264
Atlantic Transformer Co., Inc. . . . 269

Bauer, L. W. . . . 270
Beeson Brothers Engineering Co. . . . 258
Beeson Engineering Co. . . . 269
Belyea Co., Inc. . . . 251, 267
Berger Bros. Electric Motors Inc. . . . 266
Bloedel, Stewart & Welch, Ltd. . . . 264
Brearley, H. P. . . . 268

C & S Machinery Co. . . . 260
Chicago Electric Co. . . . 263
Chiswick Electric Motor Co. . . . 264
Consolidated Cement Corp. . . . 265
Crane & Co., Inc. . . . 265

DeRose, G. . . . 261
Dietrick, E. P. . . . 264
Drew & Co., Inc., E. F. . . . 248
Duquesne Electric & Mfg. Co. . . . 257

Electric Apparatus & Repair Co. . . . 269
Electric Equipment Co. . . . 271
Electric Generator & Motor Co. . . . 265
Ellis Co., A. Lee . . . 261
Erie Electric Co., Inc. . . . 263

Fletcher Sales Co. . . . 268
Freeman & Co., Samuel T. . . . 262

Glazer Brothers . . . 270
Glow Electric Co. . . . 252
Grinnell Co. . . . 270

Hall & Co., Stephen . . . 264
H & P Machinery Co. . . . 270
Heat & Power Co., Inc. . . . 260
Hemphill & Co., J. L. . . . 249
Hercules Electric Mchy. & Equip. Co. . . . 266
Howe Brothers . . . 267

Independent Electric Machinery Co. . . . 267
International Power Machinery Co. . . . 253

Johnson & Assoc. Howard Blain . . . 269

Keystone Power Plant Equip. Co. . . . 266
Kiemle Co., Fred W. . . . 270
Kirk Co., Wallace E. . . . 265

Land, L. J. . . . 261
Locke Co., C. B. . . . 269

Mississippi Valley Equipment Co. . . . 266
Moulton, Wm. C. . . . 268

National Starch Products, Inc. . . . 271
Neu Corporation, Hugo . . . 256
Northern Metal Co. . . . 269

Penn Machinery Co. . . . 268
Pennsylvania Power & Light Co. . . . 248
Philadelphia Transformer Co. . . . 264, 267
Power Plant Equipment Co., Inc. . . . 269
Public Service Co. of New Hampshire . . . 248

Rabinowitz & Sons, Wm. . . . 264
Rearick, Charles B. . . . 268

Sandman Electric Motor Co. . . . 266
Schoonmaker Co., Inc., A. G. . . . 255, 260, 268

Thompson Co., Inc., J. Parker . . . 261, 268, 270
Tippins Machinery Co. . . . 266

Utilities Electrical Machinery Corp. . . . 250, 262

Wagner Co., Arthur . . . 259
Watson & Desmond . . . 271
Wayne Electric & Manufacturing Co. . . . 271
Weaver & Co., Charles . . . 254, 264, 268, 271
Weinstein Co. . . . 268
Wilms & Co., Walter H. . . . 267
Wurth Electric Motor Co. . . . 268

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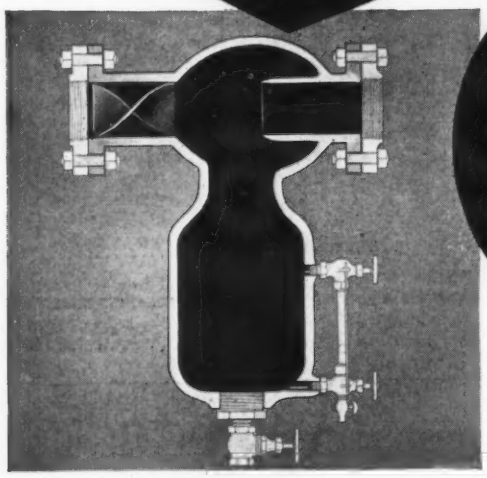
of purifying your steam & oil through **Swartwout Separators**

of drying exhaust steam through **Swartwout Exhaust Heads**



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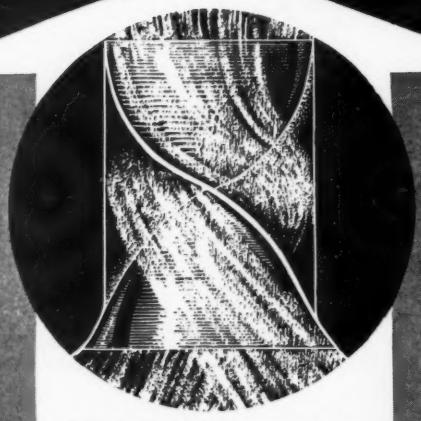

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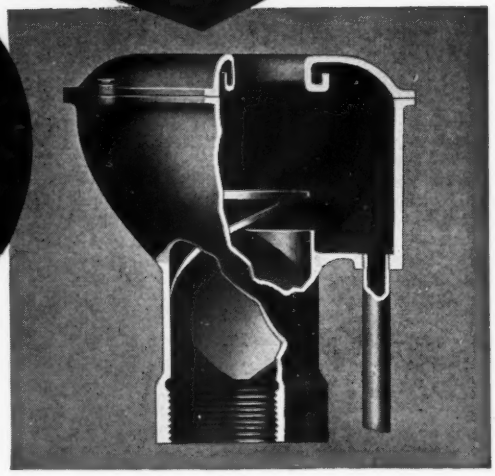
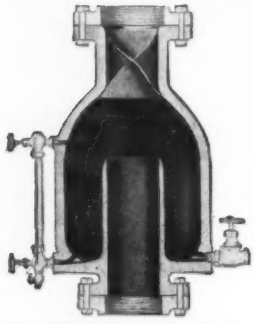
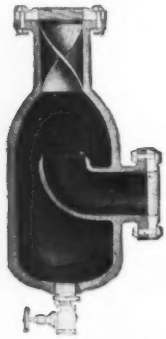




Vertical Separator



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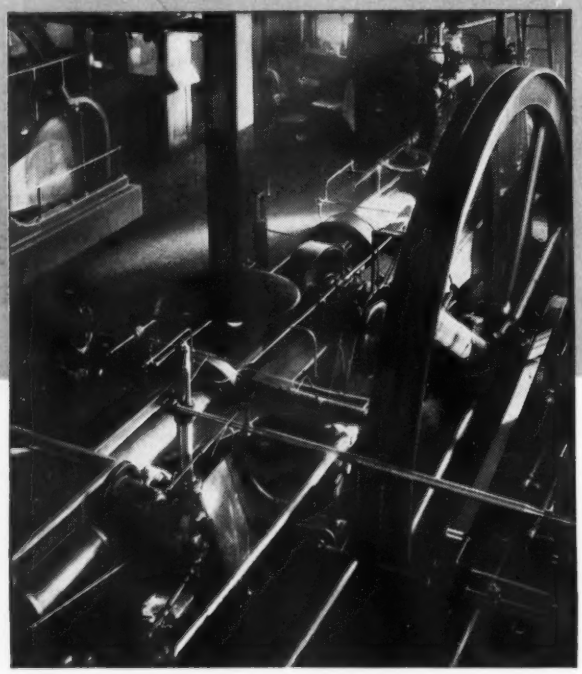

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